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# 80 micro

*the magazine for TRS-80® users*

A GW PUBLICATION

## Speed Demon

### The 80 Micro Basic Compiler

**Model 4 Scripsit  
Gets an Overhaul**

**NovaCalc: A Basic  
Spreadsheet Treat**

**Thirteen Patches  
To TRSDOS 1.3**

**How to Get More  
From Your DMP**

Also:  
The New Shop  
BBC BASIC  
Basic Tables  
Project 80  
2000 Plus



# IF SWAPPING DISKS ISN'T YOUR IDEA OF STAYING IN SHAPE...

Radio Shack's new DoubleDuty utility gives your Model 4 the muscle of two computers and makes disk-swapping a thing of the past!

## Partitioned Memory Saves Time and Effort

Just load DoubleDuty when you begin work, and throughout the day it improves your Model 4's performance by dividing the 128K memory into three independent units.

Two 64K partitions operate like separate computers. Load both with software designed for a 64K system and work with either program without reloading. The third partition allows you to perform TRSDOS library commands without exiting. And DoubleDuty does all this without a permanent—or expensive—change to the Model 4's memory!

## Get the Most from Your Model 4

Once DoubleDuty frees you from time-consuming disk swapping, you'll discover that you can accomplish more at the computer in less time.

Just think of the advantages of having the new Profile™ 4 Plus filing system and Super-SCRIPSIT™ word processing loaded at the same time. You could prepare business reports faster than ever, moving to the Profile data files for recent figures and returning to Super-SCRIPSIT without reloading your disks.



# ...GIVE YOUR MODEL 4 NEW DOUBLE-DUTY AND TAKE IT EASY!

## Introducing Profile 4 Plus

Our new Profile 4 Plus (26-1635, \$249.95) makes advanced data base management available to Model 4 owners. It's based on the same powerful system already used by Model 12 and Model 16 users. Profile 4 Plus offers you plenty of options for data manipulation, so you can personalize your filing system.

## Add Model 4 Word Processing

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iting features that let you delete, insert and move blocks of text easily. SuperSCRIPSIT supports proportional-spaced printing, multiple line spacing, underline, boldface, super and subscripts, multiple columns, 80 x 24 display and reverse video to aid in editing.

## See All Three Today

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Dealer buy inquiries: 128K Model 4. All other programs require 64K. Model 4 is presently at participating Radio Shack Computer Centers and at participating Radio Shack Electronics Stores.



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Model 4  
Producer Version  
Now Available

The  
PRODUCER

# The PRODUCER

## The Professional Program Writer.

### YOU CAN MULTIPLY YOUR PRODUCTIVITY WITH THIS SENSATIONAL SOFTWARE BREAKTHROUGH

Beginners can now program with no experience necessary.  
Professional programmers now have a tool to save days and weeks of time.

#### THE PRODUCER WRITES CUSTOM PROGRAMS FOR YOU!

Why buy expensive Data Base programs that are only half effective and require the original Data Base system disk to run the finished program? The Producer is a Program Generator that can create the exact programs you want.

You don't need any previous programming experience since The Producer writes all the code for you. And when the program is finished, it runs without the support of the original Producer system disk.

#### What Kind of Programs Can The Producer Write?

With the Producer you can create impressive, sophisticated and functional software to manage your data. The only limit is your imagination. You can quickly and easily create programs to manage such things as mail lists, personnel records, inventory control, library catalogs, loan calculations, personal finances, and maintenance schedules.

You may never again need to buy a canned program to perform a needed task related to data storage and retrieval. The Producer can write all those programs for you, including the capacity to do all standard calculations and to generate both on-screen and printed reports. The freeform report generator even allows you to design reports on your preprinted forms.

#### How Does The Producer Work?

The Producer itself is a sophisticated program based on years of research and development. But The Producer was written with the end user in mind and the program generation process is quite simple.

You can begin by using a planning form designed to help you organize your program ideas. The Producer then asks you a series of simple English questions to enable those ideas to be translated into a program format. You use the computer's arrow keys and graphic characters to draw the data entry screen just the way you want it.

Then with the press of a button, the program generator takes over and does all that complex coding for you in a matter of minutes. The result is a complete program, capable of running by itself. That means your customized programs may be used independently of The Producer. (A feature not possible with Data Base creations.) You may duplicate your Producer generated programs and even sell them for others to use, without paying royalties.

#### How Difficult Is The Producer Process to Learn?

The Producer software package makes learning simple. An easy to follow tutorial takes you through each step of The Producer process as you sit at the computer. (This includes audio cassette tapes with the Model I/III versions.) This hands-on experience not only teaches you the process but allows you to create a program of your own design while you learn. The tutorial is all you need to get started.

Later, if you have need for more specific information, you can turn to the fully indexed Producer Reference Manual. The 200 pages of documentation cover virtually any question you may have so you will never be left guessing what to do next. The Producer package also includes a quick reference card to streamline your program operation and, should you ever need technical assistance, you may call a Producer Software technician for free counsel and trouble shooting.

#### Is It True That I Can Both Create and Edit

##### At Will With The Producer?

Yes! Unlike most other program generators, The Producer gives you complete freedom to design the screen any way you wish. Experiment, rearrange, "cut and paste" between trial screens. That's the kind of versatility you get. And even after your program is complete, you can change your mind. With The Producer you can edit and refine finished programs without starting over. That's a real time saving.

#### What Are Some Other Outstanding Features Of The Producer?

- Our B-Tree file structure gives extremely fast access to data, allows global search and replace, data entry by batch mode and automatic file rebuilding.
- The Screen Generator is the best anywhere at any price and gives full screen control including graphics. You can add, insert, or delete, and move blocks of text on screen and between screens.
- All math calculations are supported including subtotals and global recalculations.
- The Freeform Report Generator gives you an amazing versatility to design text placement, interfield calculations, and formats. You can even print reports on your standard forms.
- The Producer package also includes a free Home Inventory program and a one year subscription to The Producer Newsletter.

### The Producer

**\$199.95**

Available now for TRS-80

Models I, III, IV

Ask about DATA SHUFFLER,  
New Sort/Merge Program \$34.95

78 Order toll free:

**1-800-433-5355**

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**O**wning a computer program that writes programs for you may seem like a science fiction dream. But that's exactly what The Producer does. You can now enjoy professional quality programs, custom written for your specific needs!

### Here's a sampling of what Producer users are saying:

"This program has paid for itself over and over." People tell us this repeatedly. First time computer users have successfully been able to generate programs with The Producer that rival the professional quality of programs available through commercial sources.

"There are only two things you need to say about The Producer: it's easy to use and it's powerful!" The woman who told us this had used several computers before but had no programming experience. Now she is saving time, money and effort by creating the programs she needs for her office.

"Owning The PRODUCER is like having a professional programmer on call-24 hours a day. I particularly like the fact that if I design a program to do a specific job today, and later discover it is inadequate to my changing needs, I can regenerate the program with corrections in a matter of minutes." That's right. The PRODUCER gives you the ability to edit or expand your programs in any way you choose.

"The screen generator alone is worth the price! I created a professional data entry screen in minutes just after opening the package." With our screen generator, you are the artist and you are never locked into what someone else has designed for you.

"How did I ever live without it." This often heard quote comes from experienced programmers who are now using The Producer to generate programs in a fraction of the time it previously took to them to write programs.

"The Freeform Report Generator is an amazing feature. I never thought a product like this could give me the ability to get reports on my preprinted forms, but The Producer does it all." Yes, you can put the text anywhere on the page you want, do up to 100 interfield calculations, etc. And the Freeform is now a part of The PRODUCER package.



### OTHER QUOTES FROM PRODUCER USERS

"The PRODUCER package I received was excellent. The finest software package I have ever purchased. Far beyond my expectations."

S.R. Foster, Pensacola, Florida

"I'm in love with The PRODUCER. It's one of my favorite programs."

R. Selsback, Burlingame, California

"The value of the deal, everything included, was the best I've seen to date."

G. Slusher, Martin, Kentucky

"Excellent! Above and beyond other software."

R. Hapgood, Henrietta, Texas



"The PRODUCER is the best all purpose program generator I have used. (We have tried almost all of them). The generated code is bug free, well commented and efficient."

A. Copella, Northbrook, Illinois

"This is by far my number one software and I will use it anywhere and everywhere I possibly can, both personal and in business."

R.A. Neuman, Okemos, Michigan

"The program I created with The Producer meets my needs exactly and I can change it easily as different conditions require. You can't do that with other software."

Neal Bloomfader

"One of the best I've seen. We write about 20 volumes of material per year. Take it from a pro, it's good."

J. Crespi, Sherman Oaks, California



"Thank you for an excellent program. I agree that The PRODUCER will change the entire concept of program creation in the future. But for now, you stand as the best data base management system I can buy."

E. Sung, Vancouver, B.C.

"I think The PRODUCER will make the software hackers upgrade their products to this high level quality of the PRODUCER. I'm sure you realize that there is a lot of garbage on the market."

D.J. Smith, Lombard, Illinois

"The Producer is among the best systems I have used in ten years of professional data processing."

Dennis R. Cutshall, APO NY.

### New from Producer Software THE DATA SHUFFLER \$34.95

#### All purpose Sort/Merge program

Many of you have been asking for it, so here it is. With Data Shuffler you can perform powerful sort and merge functions in conjunction with your data files • Sorts up to 32767 Records • Sorts key size up to 256 bytes • Does up to 9 sort keys in ascending and/or descending order • Includes a complete sort parameter builder program, etc.

Data Shuffler is available now for TRS-80 Models I, III, and 4. Call us to place your order for immediate shipment.

## The PRODUCER

The Professional Program Writer

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TRS-80 Model I Version

TRS-80 Model III Version

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(including Model 4-P)

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**FASTER** speeds up most TRS-80 BASIC programs by 20-50%. It analyses programs while they run, then displays a simple change to sequence variables so the ROM will find them faster.

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80 MICRO (April, 1982)

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80 MICRO (April, 1982) said "If your drives have problems I recommend RPM before paying to get it repaired."

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Models 1, 3 and 4 (in 3 mode). We suggest you order a copy before you need it.

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**T**HIS PROGRAM IS A MUST FOR EVERYONE WHO USES "BASIC" ON A TRS-80. It reduces string compression delays by 95% or more. You suffer from these delays whenever you run a BASIC program. Your computer locks up for seconds, or minutes, and you may even think it's "crashed."

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**IT SHOULD HAVE BEEN BUILT INTO THE COMPUTER IN THE FIRST PLACE**, but since it wasn't, look at this chart, and then order your copy today.

# STRINGS	SECONDS DELAY NORMAL	PERCENT TRASHMAN	IMPROVEMENT
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250	11.8	0.7	94
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1000	179.6	3.5	98
2000	713.2	7.8	98.9

Note: Not for use with The Home Assembler™

"...in those programs that use hundreds of strings arrays, the time saved is outstanding." 80 MICRO, Jan. '83

Works great, had 45 sec. delays in printing, now almost no delays. D.T.

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TRASHMAN is available on Disk for the TRS-80 Models I & III for just \$39.95

Amiga Software Edition TRASHMAN 1.12  
copy and for use with The Home Assembler™

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80 formats its program listings to run 64 characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: Submissions Editor, 80 Pine Street Peterborough, NH 03458. Include a SASE for a copy of "How to Write for 80 Micro". Payment for accepted articles is made at a rate of approximately \$50 per printed page. All rights are purchased.

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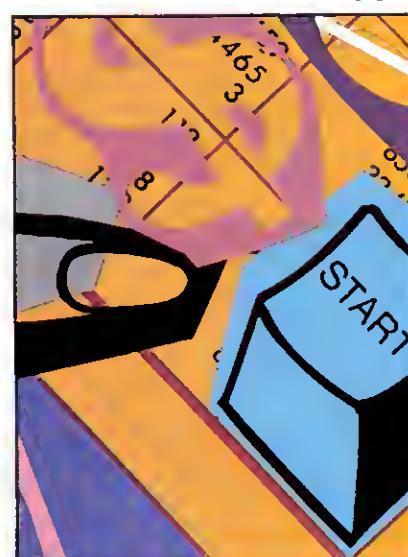
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- 60. Model 4 Scripsit the Write Way** by Clifford Knight  
Boost the power and convenience of Model 4 Scripsit with this complete package of enhancements. (Model 4; Load 80)
- 82. NovaCalc** by Daniel Garms  
Why pay for the higher-priced spread? This full-featured spreadsheet is yours for the taking. (Models I and III; Load 80)
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Create custom graphics characters with your Radio Shack dot-matrix printer. (Models I, III, and 4; Load 80)
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Get to the root of cubic, quadratic, and linear equations. (Models I, III, 4, 1000, and 2000; Load 80)

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# LOAD 80

**L**oad 80 gathers together selected programs from this issue of 80 Micro and puts them on a magnetic medium for your convenience. It is available on tape or disk, and runs on the Models I, III, and 4.

If you own a tape system, load the Load 80 tape as per the instructions provided. If you own a Model I or III disk system, boot the Load 80 disk and transfer the files to a TRSDOS system disk according to simple on-screen directions. If you own a Model 4, you must convert the

programs from Model III TRSDOS to Model 4 disk using the Model 4 CONV command.

Not all programs will run on your system. Some Model III programs, for instance, will run on the Model 4 in the Model III mode, but not in the Model 4 mode. You should check the key box that accompanies the article to find out what system configuration individual programs require.

If you have any questions about the programs, call Keith Johnson at 603-924-9471. Yearly subscriptions to Load 80 are \$199.97 for disk, or \$99.97 for cassette. Individual loaders are available on disk for \$21.97 or on cassette for \$11.47, including postage. Direct subscription problems or orders for Load 80 to Lori Eaton, c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

## Directory

### FastBas

Article: Running Like the Wind (p. 42)

System: Models I and III, 32K RAM.

Language: Basic

An updated version of 80 Micro's Basic compiler.

Cassette filespec: B, C, D, E

Disk filespec: FASTBAS/BAS, LIST2/BAS, LIST3/BAS, PONG/BAS.

### ScriptAid

Article: Model 4 Scriptit the Write Way (p. 60)

System: Model 4, 64K RAM, one disk drive.

Language: Assembly/Basic

An enhancement package for Model 4 Scriptit. Disk filespec: ENHANCE/OVL (system), REKEY/OVL (system),

PRTDRIVE/BAS, HELPEBLD/BAS. Requires editor/assembler.

### NovaCalc

Article: NovaCalc (p. 82)

System: Models I and III, 48K RAM, one disk drive.

Language: Basic

A basic spreadsheet program.

Disk filespec: NDVACALC/BAS.

### Graphics

Article: Picture Perfect (p. 98)

System: Models I, III, and 4, 16K RAM.

Language: Basic

Create your own graphics characters on your Radio Shack dot-matrix printer.

Cassette filespec: J, K, L, M, N, O, P.

Disk filespec: GRAPAPER/BAS,

CHARGEN1/BAS, CHARGEN2/BAS,

STRINGS3/BAS, SUBGRAF4/BAS,

SUBGRAF5/BAS, SUBGRAF6/BAS.

### Random Files

Article: On the Record (p. 106)

System: Models I and III, 32K RAM.

Language: Basic

Three programs that create and read random-access disk files.

Cassette filespec: G, H, I.

Disk filespec: RANDISKU/BAS, RANDISK1/BAS, LOOKDISK/BAS.

### Cubic

Article: Formula Solutions (p. 116)

System: Model I and III, 16K RAM cassette, 32K RAM disk; Models 4, 1000, 1200, 64K RAM, one disk drive.

Language: Basic

Programs for solving cubic, quadratic, and linear equations.

Cassette filespec: Q, R

Disk filespec: CUBIC1/BAS, CUBIC3/BAS, CUBIC4/BAS.

### Interrupt

Article: Project 80 (p. 120)

System: Models III and 4, 16K RAM

Language: Assembly

Demonstration program: How to use the 8259A interrupt controller with the Project 80 general-purpose I/O board.

Cassette filespec: INTRPT (source code). Requires Apparatus editor/assembler.

Disk filespec: INTRPT/SRC (source code). Requires Apparatus editor/assembler.

### BBS

Article: BBS Express (p. 132)

System: Model III, 48K RAM, two disk drives.

Language: Assembly/Basic

A routine for locating message numbers.

Cassette filespec: BBS1/source code, S.

Source code requires editor/assembler.

Disk filespec: BBS1/SRC (source code), BBS2/BAS. Source code requires editor/assembler.

### Demo

Article: The Next Step (p. 140)

System: Model III, 32K RAM, one disk drive.

Language: Assembly

Demonstration program to create a beep generator.

Cassette filespec: DEMO1, DEMO2, DEMO3 (all source code).

Disk filespec: DEMO1/SRC, DEMO2/SRC,

DEMO3/SRC (all source code). Requires Apparatus Editor/assembler.

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# FAST SORT! FAST I/O!

**NEW**

**FOR TRSDOS® 6**

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## DSM4

**The Disk Virtual Sort  
Utility for the Model 4/4P!**

**F**inally, the utility many of you have been asking for — a versatile Disk Sort utility for the Model 4. **DSM4** is a high speed, disk virtual sorting utility which eliminates the burden of sorting from your applications software. **DSM4** will create and maintain index files for you. Since the sort is disk virtual, your only limitation is the amount of available disk space, not available memory. **DSM4** can sort almost any type of field in a file. The length of each field may be up to 253 bytes. The field types that **DSM4** will handle include compressed integer, single precision and double precision fields, in addition to ASCII data. Single and double precision numbers may be in the format used by Model 4 Microsoft BASIC, or may be in 'C' floating point format (as implemented by Manx AZTEC 'C').

With **DSM4**, disk files can be up to 65535 logical records, with an LRL of 1 to 1024 bytes. You may specify up to 24 select fields to determine which records will be included in the sort. Any type of relation (e.g. equal to, less than, greater than or equal to, etc.) may be applied to your selection criteria. In addition, logical operators (AND/OR) may be used. For instance, "sort by Zip all people with a last name of either Smith or Jones". Additional fields may also participate in the sort. Example: sort in Zip Code order and alphabetically within the same Zip Code.

Sorting may be in either ascending or descending order. **DSM4** may be instructed to skip records that match a user specified "deleted record" value. You may also save a "template" of the sort/select specifications to disk, and control **DSM4** with JCL.

Perhaps the most impressive feature of **DSM4** is the speed of the sort operation. Compare these statistics to the sorting method you are currently using: Select, sort and create an index of 1000 records. Selecting and sorting on a name, zip code, and two double precision fields (41 characters) will take under 30 seconds from floppy disk, under 20 seconds on hard disk.

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# Tandy Charts a New Course

I've recently heard some complaints from long-time TRS-80 owners that Tandy is selling out by stepping into the MS-DOS market. They're disgusted by what they see as a "me-too" philosophy, and nostalgically think back to the Model 1 days when Tandy was a pioneer in the industry.

I have to disagree. The Models 1000, 1200, and 2000 do not indicate a sell-out, but a recognition by Tandy that it cannot survive, let alone thrive, outside the mainstream.

It's easy to get sentimental about the Model 1. But this sentimentality has clouded some people's perceptions of Tandy's role in the microcomputer market. They think that because Tandy was one of the first, it therefore should be at the forefront of new and creative technology.

History says otherwise. Through the years, Tandy's success has depended on effectively packaging proven technologies. It has shown a remarkable propensity for cashing in on whatever electronic consumer product happens to be hottest. It did so with stereos. It did so with CBs. And most recently, it is doing so with telephones.

In all cases, Tandy's strategy was to make an inexpensive product, sell it by the truckload through its Radio Shack retail chain, and provide convenient after-sale support. The company's method for selling computers is essentially the same.

You could argue that at some point in the distant past, Tandy could have aggressively established its Z80 computers and TRSDOS operating system as de facto industry standards, as Apple and IBM eventually did with their products. But that would have been asking the company to be something it was not.

Staying with its proprietary DOS would spell the end of Tandy as a microcomputer manufacturer. It would be like selling stereo systems that don't play 12-inch records. So let's not



mourn the decline of the Z80 computer, but instead be thankful that Tandy had the good sense to join the rest of the world.

## 1985—The Comeback Year?

1985 could very well be the most important year in Tandy's history, for it will reveal whether the company can reestablish itself as a vigorous participant in the microcomputer marketplace. The three key factors are how well the Model 1000 does, how well Model 4 sales hold up, and how well Tandy can impress itself on the consciousness of the buying public.

My gut feeling is that the 1000 is going to do well. This is the type of machine Tandy does best: inexpensive and expandable. The company should sell a good many just to its current user base. Model 1/III and Color Computer owners in particular should see the Model 1000 as their chance to enter the MS-DOS market at a reasonable price. If Tandy can also reach businesses that want a cheap alternative to an IBM PC or want to add to their current installment of PCs, the 1000 could become the company's all-time best seller.

How quickly the 1000 market develops is another matter. This is where the Model 4 comes in. Tandy must continue to sell the system during the

transition to MS-DOS. To do so, it must sell the machine creatively, by further reducing the price, bundling software, and adding enhancements. (For instance, the company might extend the 4's life if it could get Zilog's 16-bit Z800 in quantity.)

Lastly is marketing, which in Tandy's case means getting more visibility. The issue of Tandy's image has been beaten to death with a tire iron, and rightfully so. The Model 1000 is Tandy's chance to put all that criticism to sleep.

Tandy is finally realizing that selling TRS-80s is not the same as selling stuffed-animal radios and batteries. The computer marketplace is highly competitive, and exposure is critical. Unfortunately, Tandy's machines do not get the shelf space, and therefore the visibility, in retail stores that other systems do.

The beauty of the 1000 is that it can create its own visibility. While the machine won't be in non-Radio Shack retail stores, its software will. Furthermore, computer magazines will have to reckon with the 1000 when discussing MS-DOS machines and IBM clones. All Tandy needs to do is prime the pump with an intelligent advertising and promotion campaign.

Marketing the Model 4, on the other hand, is going to present problems. It has become *machina non grata* in the computer industry. Take, for instance, a recent cover article in *Personal Computing* comparing the Apple IIc and the IBM PCjr. The 4 is lumped with the Kaypro in a couple of throwaway lines, and dismissed as having "inferior graphics/color capabilities, very little entertainment or educational software and very little expandability." Considering the 4's price, power, and software base, it deserves more respect.

All in all, Tandy has reason to be guardedly optimistic. If it plays its card right, this could be the year the company makes its comeback. ■

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Our print samples were done on an Epson. Sizes vary on other printers. Some of the samples shown here are taken from the additional Letterset disks.

Two disk drives and at least 48K of memory are required. LDS is not available in native Model 4 mode.

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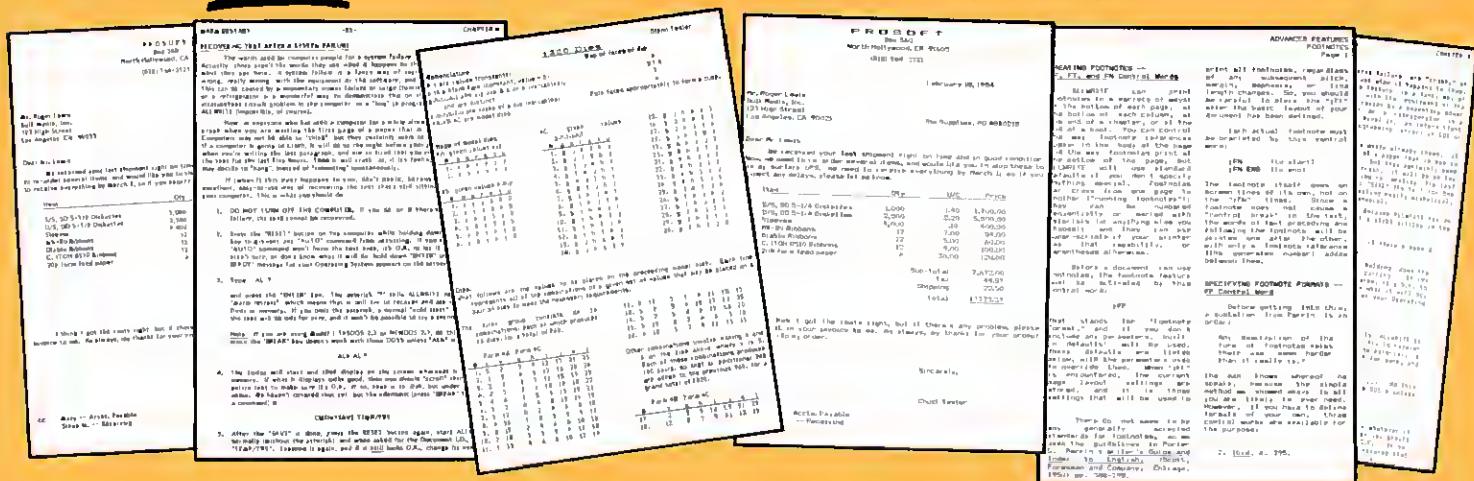
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### ALLWRITE'S Screen Handling Makes Word Processing Easier Than Ever

Change text width at any time; wide lines shift left and right as you type. ALLWRITE preserves double-blanks between sentences, uses the entire screen for text, and displays a complete Status Screen at the touch of a key. Scroll by line, partial screen, full screen, to top or end of file, or to any marked point. Move cursor by character, word, tab, line, or screen.

You can set and change on-screen tabs and store them on disk. The print-time tabbing features are incredibly versatile: they allow left, right, and centered tabs, and even line up your decimal points.

ALLWRITE shows you where you forgot to turn off underlining, boldface, italics, or double-width. Special on-screen Preview feature shows page breaks and page layouts...including underlining and boldface...without annoying blinking or screen flicker. In "Summary" mode, ALLWRITE quickly flags formatting errors without

These were printed by ALLWRITE; shown 20% actual size.

wasting time printing all the text. These standard features make document preparation faster and easier than ever!

### State-Of-The-Art File Handling

There is no upper-limit on document size with ALLWRITE, because it chains files backwards as well as forwards, even across diskettes. Switch from one chained file to another in less than six seconds by pressing two keys. Select portions of other files for inclusion at print time...great for stock paragraphs.

ALLWRITE salvages text from bad disks! If a sector goes bad, you won't lose the entire file, because it will skip bad sectors, read the rest of the file,

### TAKES FULL ADVANTAGE OF YOUR MODEL 4.

The model 4 version of ALLWRITE uses the entire 80-by-24 screen. On a 64K machine, you can edit over 34,000 characters of text. On a 128K machine, you can edit THREE FILES AT THE SAME TIME! The second and third files can be over 32,600 characters each, for a total of almost 100,000 characters of text in memory.

and then show you where the lost text belongs. This advanced error recovery turns a disaster into a feeling of profound relief.

### User-Definable Soft Keys Reduce Typing Time

You can store 22 phrases or commands at a time into "soft-keys," then press just two keys to retrieve them. This makes frequently-used phrases and formatting controls a snap to use. You can store these definitions on disk and build a library of hundreds of pre-programmed keys to fit every one of your applications.

Our specially-designed templates fit right on your keyboard to let you see your settings at all times. Each template is also a Reference ("Cue") Card, so it is always right in front of you when you need it, without using up valuable screen space.

### ALLWRITE Is Easy To Learn

ALLWRITE's commands and control keys are easy to remember because they use the first letters of common English words: 'CE' stands for 'Center,' 'Search' and 'Replace' do just that, and so forth. The on-line HELP menu offers over fifty screens of topics.

NEWSRIPT's documentation was acclaimed in every review, and ALLWRITE's 350-page book is even better. Portions of it are designed for beginners, with every feature clearly explained in step-by-step tutorial style. Since you won't always be a beginner, other parts of the book offer advanced topics. There is a cross-reference summary chapter, a 14-page comprehensive index, and a detailed Table of Contents. We've been developing computer programs and manuals for over 20 years, and understand the importance of good documentation.

To make installation easy, we include Tiny DOSPLUS for the Models I and III, and special, pre-tailored versions of both TRSDOS 6.2 and DOSPLUS IV for the Model 4, all at no extra charge. The Model I and III versions work equally well with all major DOS's.

### PROSOFT'S On-Going Customer Support

Perhaps the best reason of all for having ALLWRITE is the continuing support we offer you: friendly, expert, direct support that is unsurpassed in the micro-computer industry. There is no time limit to our support: if you are our customer and you need help, just call or write. We give free updates for 90 days, and charge little or nothing for minor updates thereafter.

## Customer Comments

"This is the best software package I have ever received...superb, easy to use, fast, and has more features than the business word-processor at the office." (E.R.L.)

"ALLWRITE is a professional system that sets a new standard in word processing. It's powerful and easy to learn and use."

80 MICRO, Nov., 1984

"Your company and products have to be one of the strongest factors I can think of for keeping me with the TRS-80!" (J.R.H.)

"NEWSRIPT is the Cadillac of word processors. ALLWRITE is the Mercedes Benz!!" (B.E.)

"...a very readable manual." (D.S.)

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You probably know that quality word processors for CP/M and the IBM-PC sell for \$300-500, and they don't have ALLWRITE's capabilities or speed...or PROSOFT's proven, on-going support. Now, for a fraction of the cost of a new computer, you can have the most complete word processor of all. And you won't have the headaches of starting all over again with a new, different computer.

Note to college students: with its Footnote, Table of Contents and Index features, ALLWRITE is ideal for your reports and Term papers.

## HUNDREDS OF USEFUL CAPABILITIES

ALLWRITE comes with just about every useful word processing feature...standard. Here are some highlights: excellent right-justified proportional printing on most printers having that ability; powerful Form Letter and Mailing Label preparation; instant counts of words, characters, lines, changes; block Move, Copy, Delete, Putfile, Getfile, and List; delete by character, word, line, sentence, paragraph, or block; insert and one-key insert; great RS-232 printer support; accepts all 256 ASCII codes from keyboard; intermix pitches on same line (printer-dependent); 1.5 line spacing, 6, 7, 8, 12 lines per inch (printer-dependent); does multiple-columns on all printers; perfect alignment of hanging indents; variables, logic statements, conditional printing; wildcard Directories; integrated with Electric Webster and DOTWRITER for Models I, III, and 4 (these are sold separately); "Legal" line numbering; paragraph, list, and figure numbering; supports most popular printers (all "printer drivers" included); compatible with high-memory drivers; fully explains all DOS and ALLWRITE error messages; wildcard search-replace; tabs, search-replace, other settings remembered across files; word reversal; up to nine levels of boldface; flexible page titles; footnotes at bottom of page or end of document; Table of Contents and Index generation; and PROSOFT's unmatched text formatting and printing capabilities.

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## NICE Perspective

I found R. Walter Steur's review of NICE (October 1984, p. 39) shallow and overly negative. Steur ignores the fact that NICE is one of the most flexible and versatile TRS-80 packages available.

NICE isn't perfect; its documentation, for example, leaves much to be desired. Yet, when considering its performance and capabilities, I think NICE deserves a four-star rating.

*Michael R. Keller  
Skowhegan, ME*

## Where's The Disk?

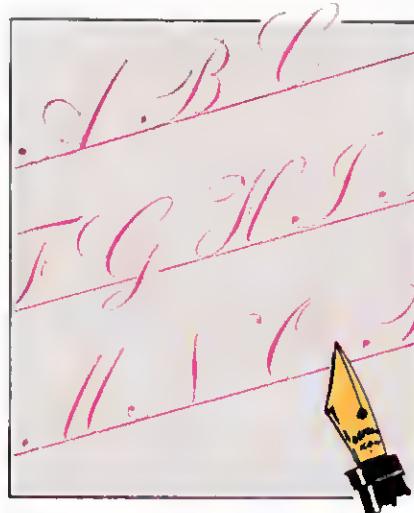
Contrary to what's stated in Table 1 of Hardin Brothers' "Making Your Selection: Choosing the Right Editor/Assembler" (September 1984, p. 60), Radio Shack's Series 1 Editor/Assembler includes only the Model III disk in its package. In place of the Model I disk that I wanted were instructions for exchanging the enclosed disk for a Model I disk. If it's the Model I disk that you're after, I advise that you open the package before buying the product.

*G. F. Mueden  
New York, NY*

## Communicating

I disagree with what M. J. Batham refers to as "drawbacks" in her review of Videotex Plus (September 1984, p. 168). First, hex codes are required only if you use the SETCOM feature on an automatic log-on. If you use the clear-Q keys to configure the program, you're presented with a chart of baud rates or UART configurations. Then, all you have to do is select the number conforming to the baud rate of the desired configuration.

Secondly, Batham states that you can't go back into DOS without logging off or redialing the host computer. I do this all the time; just exit using clear-X, and then reload Videotex Plus. You will, of course, lose



information sent by the host computer while you're out of Videotex Plus.

Finally, control-P doesn't send the signal that prints the contents of the buffer; rather, it sends a control-P to the host computer. It's clear-P that prints what's contained in the buffer.

*L. J. Kuttell  
St. Louis, MO*

The inaccuracies in M. J. Batham's review of Videotex Plus can't be ignored. The program is capable of generating a true break signal; p. 23 of the User's Guide and the on-screen help menu both state that the F3 function key generates this.

You turn on the printer with clear-or control-R, while clear- and control-P is sent to the RS-232 board. In addition, Videotex Plus doesn't support XMODEM protocol, but instead supports CompuServe's B protocol.

*Adam Rubin  
Wappingers Falls, NY*

*In reviewing Videotex Plus, I tested the program extensively using the Model 4 to communicate with CompuServe and a local IBM-type BBS. Hex codes are required to use Videotex Plus's auto log-on feature. Pages 8-11 of the manual explain how to input hex codes, yet it's confusing to a user who doesn't know hex. The only way to return to DOS is to*

*exit the program which, in turn, makes you lose information from the host computer. Other telecommunications programs allow a return to DOS while capturing data in the buffer.*

*Control-P on my version (1.00.00) toggled the printer, allowing it to print the contents of the buffer. Page 25 of the manual explains the clear-P option to print the buffer contents. The use of both P and R are similar, with R acting as a print screen function, and P as a print buffer option.*

*Adam Rubin is correct in stating that the F3 key generates a break, yet the break key doesn't initiate a true break. When following the instructions on p. 31 of the manual, I had no difficulty with file transfer using the XMODEM protocol. In doing this, I also used the No option to turn off the XON/XOFF support.*

*M. J. Batham  
Des Plaines, IL*

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Send any questions or problems dealing with any area of TRS-80 microcomputing to *Feedback Loop*, 80 Micro, 80 Pine St., Peterborough, NH 03458.

**Q:** I've been helping a friend upgrade his Model I from 16K to 48K. He's had problems with the Model I's random-access memory and I was thinking of speeding up the RAM-refresh signals. Dennis Kitsz, in *The Custom TRS-80*, says "locate Z69, and cut the trace running from pin 5 to pin 12. Connect pin 12 to pin 13. This speeds the memory-select process (from MREQ and RD) just a tad."

However, an old *80 Micro* Exclusive Oracle column says "Find Z89, locate the circuit trace running from pin 5 (it runs back underneath Z69). Cut that trace. Jumper pins 10 and 12 of Z69 with a short piece of wire." I figure one of them must be right. I'd appreciate it if you could tell me which one.

Also, what is Dennis' full address? I have no street address, and my post office says it can't deliver a letter without one. (Steven Maguire, Port Richey, FL)

**A:** Not to worry; the two methods are electronically equivalent. The first is slightly more reliable. Both generate the memory-select signal a cycle ahead of design, giving the memory more time to react and deliver data.

Your post office people are naive. Dennis Kitsz' complete address is Roxbury, VT 05669. When the total population of a town is about 100, street addresses are superfluous.

**Q:** An LNW ad on the back of *80 Micro* says that the Team computer is compatible with Radio Shack's Models I, III, and 4. How compatible is compatible? I've had



quite a few problems with my Model III due to lack of cooling and/or ventilation. Also, I'm at the point where I need the added capabilities of a machine like the LNW. So overall, how would you rate the Team?

I use Cobol and SuperScripsit with TRSDOS 1.3 and I want to move them to DOSPLUS 3.5 (or 4.0 if I get the LNW). How can I do this without knowing the passwords? I have patches from MicroSystems to make them work under DOSPLUS, but how do I move the programs?

Finally, when I write (in Cobol) to a DMP-2100 printer, the underline feature turns on and I have to turn off the printer to reset it. Can you or anyone else help me with this one? (Rick C. Chandler, Brentwood, TN)

**A:** Get a cooling fan for your Model III. Radio Shack sells muffin fans that'll do the job. If you want something a bit more attractive, look for a 4-inch box fan at a local electronics store. It shouldn't cost more than about \$20.

Model I/III/4 software seems to be better than 90 percent compatible with the LNW. I can't give an opinion on the computer as I haven't seen it.

As for the passwords for SuperScripsit and Cobol, MicroSystems should be able to give them to you, or tell you how to get the job done. I be-

lieve their Transfer utility will move the program by ignoring the passwords and protection levels, but the programs will still have these attributes on the new disks. Check your manual for more information.

I don't know what to suggest for your printer problem except doing a dummy write, turning off the printer, resetting the underline, and continuing with the job. Try looking up the underline codes in the DMP-2100 manual and sending the turnoff code in a Write command.

**Q:** I have a 48K, dual-drive Model III on which I use Scripsit to write novels. I desperately need more RAM. Is there a way to increase the RAM in my machine? Do you know of a patch that adds underlining to Scripsit?

Second, are you familiar with Holmes Engineering's Sprinter Three? Does it work? What, if any, problems are associated with it? (Howard Davis, Vail, CO)

**A:** Unfortunately, you can increase the amount of available RAM, but Scripsit won't recognize it. If the buffer space is inadequate for the file size you're using, I suggest that you get a new word processor such as Newscript, which lets you chain individual buffers into one long printed manuscript. Acorn Software's SuperScript program patches Scripsit to add features like underlining and boldface. You can order the package from Acorn at 634 N. Carolina Ave. S.E., Washington, DC 20003, 202-544-4259, \$50.

Sprinter Three speeds up CPU operation. Cassette and disk I/O automatically slow down to normal CPU speed to maintain compatibility with other Model IIIs. You can increase CPU clock speed by 50 percent; increases of 100 and 150 percent are possible but you might have to replace some of your computer's integrated

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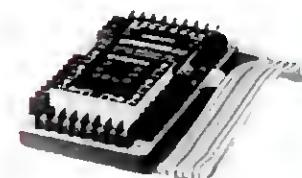
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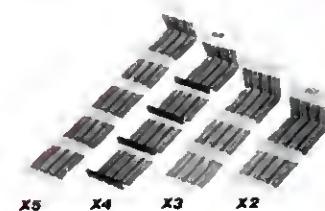
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## FEEDBACK LOOP

circuits (memory and associated chips) with higher quality chips.

**Q:** I have some comments about Model 4 software. I recently purchased CP/M+ from Radio Shack, and my biggest complaint is that a number of files are missing.

My Model 4 has double-sided drives. The CP/M+ manual provides instructions for reconfiguring the Basic input/output system (BIOS) and Basic disk operating system (BDOS). The only problem is that the CP/M+ package lacks the necessary BIOS or BDOS files. When I requested help, Radio Shack told me that it wasn't going to support CP/M+ and that I'd have to go to Digital Research to get the necessary files.

I also requested help with installing Wordstar 3.0. CP/M+ is configured to be a DEC VT52 terminal, but the installation program doesn't include a configuration file for this terminal. I finally bypassed the problem by installing Wordstar as a Heath H19/H89 terminal, which is DEC VT52-compatible.

I configured my system to use the click filter, which produces a noise each time you press a key. The click filter conflicts with SuperScripsit. I asked the computer service rep at the local Radio Shack if there were any patches to get around the problem. After two weeks, I was told that the two programs conflict and that I'd have to turn off the filter when using SuperScripsit. I already knew this. (Gerald Crosby, Columbus, OH)

**A:** Thanks for writing. Does anyone know of a patch that takes care of the SuperScripsit problem?

**Q:** Regarding Christopher Jensen's question about using Enhanced VisiCalc on the Model 1 (April 1984, p. 14): Logical Systems Inc., maker of LDOS, has a patch that lets you run Enhanced VisiCalc on both the Models I and III. It works under LDOS or SmallDOS. The patch is public domain and comes on a disk of patches called the Fix Disk. The disk is \$10; you can reach Logical Systems at P.O. Box 23956, Milwaukee, WI 53223, 414-355-5454. (Robert M. Connors, APO NY)

**A:** If it isn't too much of an expense, readers should get LDOS when they want to use Model

III software on a Model I. They'll also have to buy a double-density modification (and most Model III software requires the additional drive space available with double density) but that's still cheaper than a new Model 4.

**Q:** I recently bought a secondhand Model III and took it home in my car. When I tried to call a directory for the drive 1 disk, I got an error message (data lost during disk I/O). I had Radio Shack align both drives, which cost me \$60, but the problem returned after a week. Radio Shack fixed the drives again, at no charge.

The computer worked fine for two months. Then I took it to work in my car, and it did it again. I have a sneaky feeling that the ride in my car is shaking the computer and moving the drives out of alignment. Is this possible? Is there a special disk I can use to protect the drives when transporting the computer; if not, can I realign the drives myself? (Dorothy Belk, Little Rock, AR)

**A:** The problem is definitely vibration, but your drives shouldn't be that sensitive. I suspect that the alignment screw is a bit loose in its fittings. If you must move the computer around, get the Disk Drive Analyzer from J & M Systems (137 Utah NE, Albuquerque, NM 87108, 505-265-1501; \$79 for single-sided drives) so you can test your drives. This program and disk are the next best thing to having a professional technician with an oscilloscope look at your drives.

**Q:** I've been having problems saving longer programs on my Radio Shack Series 1 Editor/Assembler. Could it be the computer or tape recorder? Is there a limit to the size of a file the editor/assembler can save? The manual doesn't mention any such limitations. (Rodney Maglente, Chicago, IL)

**A:** Series 1 is limited to a maximum file size of 211 lines (note that the limit is lines, not memory). If you're having problems with files smaller than that, I suspect that the tape recorder head is drifting as you're writing or loading a file, but that should give you some type of error message when the file fails to load properly. If you aren't getting the er-

ror message, I'm stumped. Does anyone else have ideas or comments?

**Q:** Here's an additional suggestion for Don Schenberger (March 1984, p. 15) regarding the "Diskette?" prompt. If the cable from the disk drives' controller board to the CPU board doesn't make good contact, the prompt can appear, so the problem could be hardware related.

I'd like to know the relationship between Model 1 Scripsit and my version, 3.2. Craig Lindley's patch program for Model 1 Scripsit (October 1982, p. 276) doesn't work with my version. Does Scripsit 3.2 occupy different memory locations? Is there a disassembled listing of version 3.2 available so that I can install some of the patch functions?

Also, would you recommend a good disassembler program for the Z80A as used in the Models III and 4? I'm interested in one that converts machine hexadecimal code into symbolic or mnemonic code. (Stephen A. Torko, North Bend, OR)

**A:** Patches for programs on the Model I invariably don't work on Model III versions of the same program. The problem is that disk and printer I/O routines are almost totally different. If you want patches that make Scripsit much easier to use, try Acom's Superscript. For more information, see my answer to Howard Davis' letter above.

I don't know of any disassemblies of Scripsit 3.2 you could buy. Can anyone else help? I'm not familiar enough with the disassemblers currently on the market to make a suggestion.

**Q:** I have a late-issue Model I with an RS Expansion Interface, for which I bought double-sided drives (Tandon TM-I00-2). To date, I've been unable to access the second side. My DOSPLUS 3.5 and LNW 5/8 doubler perform flawlessly as long as I've configured only one side. I run into problems when I try to generate a double-sided master of DOSPLUS. I've tried several copies of DOSPLUS and even had the SYSGEN utility replaced, suspecting it was at fault. I feel that I have some kind of hardware problem, and that the computer isn't physically accessing the second side. Any suggestions? (Chuck Fullgraf, Aiken, SC)

## FEEDBACK LOOP

**A:** To the best of my knowledge, DOSPLUS 3.5 works with double-sided drives. Before you try SYSGEN the system disk, use the CONFIG command to access the second drive as a double-sided drive. Once DOSPLUS knows that the second disk has two sides, you should be able to verify and use both sides of any disk in that drive. Don't forget that you have to use double-sided disks; single-sided disks won't format as double-sided unless you've altered them properly.

As soon as you finish with the CONFIG command, format a double-sided disk. If the second side fails to verify, check the configuration of your system and make sure that the disk in drive 1 reports as being double-sided. If it is, and you still can't format both sides of a disk, you definitely have a hardware problem.

Call LNW to make sure your doubler supports double-sided drives. Then check with MicroSystems Software and see if you're doing anything wrong with the CONFIG command, and ask for advice. Finally, take your drives to a technician and have them checked out; they might have a jumper that needs to be set, or some other such silliness.

Once you get DOSPLUS working on both sides of your second drive, you can then SYSGEN a master DOSPLUS disk for use in drive zero.

**Q:** I bought a Model 4 from Displayed Video, but I didn't receive a TRSDOS 6.0 registration card. How do I get one? Can I expect TRS-80 equipment from dealers like Displayed Video to be equal in quality to all-Radio Shack equipment?

Also, is there a way to solve the problem of losing characters when words wrap around in SuperScritpsit? Do any software companies offer modifications to SuperScritpsit? The features I have in mind are indexing, footnoting, and so on. Since software firms seem to be advertising less in magazines like *80 Micro*, where can I learn about new programs for the Model 4?

Finally, why can't I directly transfer files between a Model 4 and a Model 100 via the cassette interfaces? Is it absolutely necessary to have an RS-232C interface? (Hugh Ruppersburg, Athens, GA)

**A:** Only Tandy gives out registration cards, but you're in luck. Tandy just released TRSDOS 6.2. If you go to a local Radio Shack store and ask for the updated DOS, you should get a new registration card with it. And they shouldn't charge you for the update.

Buying from third-party companies that provide their own memory and drive upgrade is a *caveat emptor* situation. Usually you get equipment equal in performance to standard Tandy devices, but that's not a guarantee. Sometimes you'll get equipment superior to Tandy's. Rarely will you get inferior equipment, but it's possible. In 99 percent of the cases, as long as you stay within the normal operating specifications of a standard Model 4 (that is, don't try to add speed-up kits, super-high-density drives, etc.) you won't be able to tell the difference between standard and non-standard Model 4's.

I haven't heard of any solutions for SuperScritpsit's losing characters during wraparound, and I don't know of any companies selling patches or enhancements for the Model 4 version. To find out about new software, check the New Products section of this magazine. If you're looking for a word processor with automatic indexing and table-of-contents capability, give Prosoft's Allwrite serious consideration (for a review, see p. 35 of the November 1984 *80 Micro*).

While the Models 4 and 100 use the same techniques and baud rates to save data to tape, there's one big difference: The Model 100 saves a title before the data, and the Model 4 doesn't. The Model 100 rejects Model 4 tapes because they aren't identified by a title, and the Model 4 rejects Model 100 tapes because the computer requires a line number before the title. You need a machine-language routine that creates a title when saving programs from the Model 4, or one that ignores the disparities in the files when you're loading from one machine to the other.

**Q:** I've had the same problem as Robert Goodman (April 1984, p. 16) with the automatic 60-line count in Basic. If he begins each print series with a PRINT CHR\$(28), the auto line count will reset to zero. (Galen F. Tustison, San Marcos, CA)

**A:** In other words, before starting a print job, line up the paper to the top of the page, send a CHR\$(28) to the printer, then start printing. Now the six-line skip will occur at the page perforations, making for a clean printout. Thanks for the advice.

**Q:** Does anyone know where I could beg, borrow, or steal a Micro Design MDX-2 expansion interface board? Micro Design has discontinued it. I'll accept a slightly used or damaged board, but I'd prefer a board in its case, with the complete set of manuals. (Steve Winokur, Horsham, PA)

**A:** All right, folks: Does anyone out there know where Steve can get an MDX-2 board?

**Q:** I'm looking for Forth for my Tandy 2000. Laboratory Microsystems Inc. of Marina del Rey, CA, has a package, but it's based on the 8086 microprocessor. I've read that the 2000's 80186 has the 8086 instruction set in it, and therefore Forth should execute. Is this true? Also, does the 2000 have a math coprocessor included, or can I use the 8087-3? Better yet, do you know of a version of Forth written specifically for the Tandy 2000? Is Microsoft planning to publish one for its MS-DOS system? (Ron Watkins, Tucson, AZ)

**A:** Yes, 8086 Forth will run on the Tandy 2000, but you must make sure you have a version designed for that computer. Just as you can't run Z80 SuperScritpsit on every Z80 computer, you can't run 8086 Forth on every 80186 computer. The program must be customized to use the computer's keyboard, video, and disk drives.

Before investing in a commercial program, try contacting Forth Inc., 2309 Pacific Coast Highway, Hermosa Beach, CA 90254. They own the Forth trademark and are responsible for distributing FIG-Forth, the public-domain version available for almost all computers. ■

*Terry Kepner is a writer and programmer, and an Associate Editor of 80 Micro. He's been writing about microcomputers since 1979.*



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# Hard Facts About Tandy's New Software

## Tandyland

Radio Shack's fall line-up of new software had something for everyone, with offerings for the Models III, 4, and 2000. Tandy 2000 owners will notice a new terminal package called Softerm-2000 on the shelves as well as two programs from the popular PFS series, PFS: Graph and PFS:Write. The introduction of new business software for the 2000 shows Tandy's continued commitment to its first MS-DOS machine despite the debut of its IBM-compatibles.

For the Model 4 owner, fall brought new business programs, including Financial Management, Profile 4, Radio Shack's Money Decision series, and an educational package called Introductory Science.

Model III gamers weren't forgotten, either; Computer Diplomacy, Frogger, and Zaxxon are now available for the Model III. Radio Shack also sells a Model 4/4P version of Zaxxon.

**Meanwhile,** Tandy's entry into the IBM-compatible world means some big changes in Radio Shack's software market. Unlike the good old days, when Radio Shack was the primary software source for its proprietary TRSDOS operating system, the Shack now has plenty of competition for Model 1000/1200 software sales.

When *80 Micro* asked if the introduction of the new machines might put Tandy out of the software business, Tandy 1000 buyer David Frager responded, "Tandy will continue to produce software for all its machines as the need for software arises. If we

edited by Bradford N. Dixon



Photo 1. The Tandy 1200.

see a need that isn't being filled by a third party MS-DOS software company, we will definitely examine if we should provide the product."

Frager also noted that Radio Shack's Express Order software program won't offer much MS-DOS software for the Tandy 1000 because users can get MS-DOS titles at other computer stores. Nonetheless, Radio Shack Computer Centers will carry selected third-party titles that they deem to be high-quality products.

Among third-party MS-DOS products Radio Shack is stocking are Ashton-Tate's Framework and dBase III, all of the PFS titles from Software Publishing, and MicroPro International's WordStar Professional.

**Model I/III/4 owners who move over to Tandy's new hardware offerings, the Models 1000 and 1200, may be in for a case of sticker shock when they start checking out the price of MS-DOS software. For example, Lotus' son of 1-2-3, the integrated package Symphony, sports a price tag of \$695.**

Print and television advertising campaigns have made Symphony a visible product. But sales and conversions from 1-2-3 haven't lived up to expectations, and price may be partly to blame. Turning to Symphony's chief competitor, Ashton-Tate's Framework, won't save you money—it retails for the same price.

For those who don't mind spending as much on a program as a lot of people spend on a computer, Symphony and Framework should run as-is on the Models 1000 and 1200.

Almost as soon as Tandy introduced the Model 1200 (Photo 1), its "mirror-image" IBM PC XT work-alike, rumors about where the computers were being manufactured started to fly. According to the most prevalent rumor, Tandon Computer Inc. was the manufacturer.

When *80 Micro* asked Ed Juge, Tandy's director of computer marketing, about the story, he said that company policy dictates that the company's sources remain confidential. Juge noted that he, too, had heard the rumor, but would neither confirm nor deny it.

**Radio Shack Computer Centers** are polishing their image with a slick new flyer aimed at potential computer buyers for business, education, and home use. It's a vast improvement over the old flyers that were stuffed into Sunday newspapers.

Called "Radio Shack Computer Center Answers," the brochure (Photo 2) poses questions from a hypothetical computer buyer; the answers, of course, highlight a Tandy machine that exactly meets the ques-

titioner's needs. The flyer looks like a newsletter printed on glossy stock.

This new ad campaign may well bring attention to the quality image Tandy wants to communicate to buyers. It's yet another example of the Shack's long-overdue effort to solve its image problem.



Photo 2. Tandy's new brochure, "Radio Shack Computer Center Answers."

**Bulletin:** "There is a new version of TRSDOS 6 which contains several improvements and also includes some new features not previously available in this operating system. Upgrading to this new operating system is required."

These words are taken from a Tandy customer service bulletin dated March 15, 1984; similar notifications are mailed out for upgrades of other operating systems or software. The final paragraph of these customer service bulletins instructs the software owner to pick up an upgrade at the local Radio Shack Computer Center. All well and good, but what's a customer to do when he gets to the computer center and there's no upgrade waiting for him? It's bad enough when the new software isn't in the local store; sometimes a customer may be told it's out of stock at the Fort Worth warehouse as well.

Fear not, there is a way to get the first available upgrade even though the warehouse is empty. Tell the manager of your computer center to order the upgrade with your name and address on it. Then, the next time the warehouse receives a shipment of the upgrade, your order will be flagged and sent.

It seems that computer center managers can order upgrades in two

ways: for their own inventory or by customer name and address. Inventory ordering has a lower priority than special orders and when shipments come into the warehouse, they aren't earmarked for the stores needing upgrades. If the stock is there, it's sent out, but if it isn't, then the store manager has to try again later. Only personal orders are flagged.

The logic behind the arrival of cellular remote telephones in some Radio Shack Computer Centers became a little clearer last fall with the announcement that Radio Shack had worked out a customer referral arrangement with mobile telephone companies in five major markets. The companies involved are NYNEX Mobile Communications, PacTel Mobile Access, NewVector Communications, Contel Cellular, Gencom, and Bell Atlantic Mobile Systems Inc.

Tandy's press release didn't say exactly how much Computer Center space would be devoted to telephones, but considering the number of computers available from the Shack, things may get a little crowded in those stores that support the new marketing venture.

## New Threads

"Phone booth journalism" was the phrase reporters used to describe how Radio Shack's Model 100 changed their reporting habits at last year's Republican National Convention.

According to Tandy, the lap-top portable revolutionized political reporting in the 1984 election. Press planes were full of reporters using Model 100s to write stories; when the planes landed, reporters raced for phone booths to transmit their stories to host computers back at the newsroom.

Reporters from the *Wall Street Journal*, the *New York Times*, the *Washington Post*, and the Associated Press were among those using Tandy lap-tops at the convention. Tim Gallivan, AP's news technology editor, notes that AP owns about 200 Model 100s. Gallivan says that, to his knowledge, AP was the first news organization to adopt the notebook-style computer for remote reporting;

the wire service had the computers even before Tandy distributed them nationally.

**With one foot in the grave,** Lobo Systems of Santa Barbara, CA, introduced a \$795 Model 4P clone that runs LDOS and CP/M software. The Mini Max, as it's called, is designed to go head to head with Radio Shack's transportable. Lobo already has a Model III work-alike in its Max-80, which retails for \$945.

Lobo's president, Robert Bledsoe, quoted in the Oct. 15, 1984 *InfoWorld*, said he didn't see any problem in staying with a CP/M machine or in competing against Radio Shack. Bledsoe hopes sales will offset some of Lobo's \$1 million in liabilities. "There's enough demand for CP/M-based machines," he said. "If we can sell 100 to 200 machines a month, that will meet our needs. We aren't looking for high volume."

Lobo may be the last of only a handful of one-time Radio Shack clone manufacturers. According to the *InfoWorld* piece, LNW Computers of Tustin, CA, the only other surviving clone maker, was reportedly out of business as of late September 1984.

**Another ruling from the courts** in the complex area of software copyrights: Federal Judge W. Arthur Garrity of Massachusetts ruled on Aug. 31, 1984, that copyrighted programs published in a computer-user magazine may not be put on disk, duplicated, and sold by a third party.

*Nibble Magazine*, for Apple users, had sued Amtype Corp. for copyright infringement for selling the magazine's programs on disk. *Nibble*'s publisher, Micro-Sparc Inc., already provides such a service by selling program disks for \$20-\$30.

In its defense, Amtype said it offered a "typing service" to readers of *Nibble* and other similar publications. Amtype charged between \$7-\$10 for putting all the programs from a single *Nibble* issue on a floppy disk.

Judge Garrity was to rule on possible damages at a later date.

## MicroTrends

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## PULSE TRAIN

tino, CA, released some statistics last fall that put them in third place in the personal computer market. The former third-place company was Tandy Corp.

Hewlett-Packard made a point of the fact that it couldn't confirm or deny the validity of the statistics that put the firm right behind IBM and Apple. However, HP credits its apparent rise to third place to the success of the HP 150 Touchscreen Personal Computer.

As for market share, IBM holds first place in the \$1,000-\$6,000 desktop/portable market with 33 percent of sales, Apple comes in second with 20.7 percent, and HP is a distant third with 6.1 percent. Tandy Corp. now holds fourth place, according to the information supplied by HP, with 5.2 percent of the desktop/portable market (see Table 1).

Manufacturer	Percent Market Share
IBM	33.0
Apple	20.7
Hewlett-Packard	6.1
Tandy	5.2
DEC	3.0
NEC	3.0
Others	29.1

Table 1. Hewlett-Packard's ranking of the top firms in the \$1,000-\$6,000 desktop/portable market.

**What's ahead for the business office?** Frost and Sullivan, a New York market research firm, recently released a study predicting that personal computers will shape the course of office automation over the next five years. That isn't hard to believe, but the dollars involved may come as a surprise.

The report indicates that word processing applications sales will increase by 23 percent to \$10.7 billion by 1988. Unit sales for word processing equipment are expected to increase by 30 percent yearly. That's because of the inroads personal computers have made into the managerial and professional ranks: According to the wordy report, "The multifunctional capability of both word and data processing of the desktop computer makes it well suited to the needs and tasks performed by those in these job levels."

Frost and Sullivan considered as word processors dedicated units and

even electric typewriters, but predicted that personal computers will become the major component of the word processing market for the next five years.

Speaking of growing computer use, some new figures show a startling leap in the number of computers available to public school students. According to Quality Education Data, a Denver research marketing firm, the number of students per microcomputer has dropped by half since 1983. During the 1983-84 school year, the national average was 170 students per micro; by the beginning of the 1984-85 school year, that average had improved to fewer than 85 students per computer. The top school district is Florida's Broward County, where the ratio is 23.4 students per computer.

QED's report, called "Top Fifty Districts," also showed some gains by IBM in the battle for the educational dollar. Big Blue's share jumped from 4.6 percent of all micros in schools in 1983-84 to 6.05 percent for the current school year.

Apple computers, however, still dominate the education market, with a 47.9 percent share among large school districts. Radio Shack holds second place with 22.4 percent and Commodore is in third, according to the report, with 10.4 percent. IBM remained in fourth place despite its increased infiltration (see Table 2).

### Hot Items

**Software Arts of Wellesley, MA**, the company that developed the classic spreadsheet program VisiCalc, has been working for some time to come up with another blockbuster program. Now it may have one: a PC desktop management program called

**Spotlight**. Belonging to the new genre of microcomputer accessory software, Spotlight acts as a calculator, note pad, appointment calendar, telephone book, and index file deck. In fact, the program sounds very much like the Tandy DeskMate program that comes bundled with the Tandy 1000.

Desktop management programs have gained attention since Apple introduced one with their Macintosh a year ago, and the price for such programs remains fairly reasonable. Spotlight retails for \$150, a moderate price for professional software, but not exactly chopped liver. If the program is comparable to the Tandy DeskMate, then the rock-bottom price of the Tandy 1000 is even more of a bargain.

**Yes, but can you back it up?** Elite Software Systems of Albany, NY, is staking some serious money on its claim that its new encryption program, Encomp, defies piracy. The company is so confident of its MS-DOS-based product, it's offering a \$10,000 reward to any individual who can break the code. Elite will award an additional \$2,000 to the dealer who sold the program.

IBM's relentless quest for more memory in less space took another step forward recently as the computer giant began producing volume quantities of a 256K chip.

The 50.5-square-millimeter chip occupies only twice as much area as a 64K chip and makes it possible to assemble more than 4 million characters on a 7- by 9-inch circuit card. The significance of all this becomes clear when you consider that in terms of real storage, you could put the contents of a 1,400-page book on a single chip. ■

Manufacturer	Number of Units		
	Fall 1984	Fall 1983	1984 Market Percentage
Apple	35,256	15,879	47.9
Radio Shack	16,495	10,098	22.4
Commodore	7,700	3,494	10.4
IBM	4,449	1,676	6.0
Atari	3,200	3,106	4.3
Texas Instruments	3,180	952	4.3
Franklin	2,151	1,102	2.9
Others	1,139	525	1.5

Table 2. 1984 computer market shares in the top 50 U.S. school districts.

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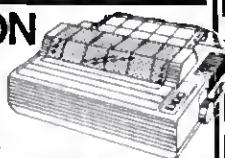
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• 15" carriage

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160 CPS,  
10" carriage ...  
**\$449**

**EPSON LQ 1500**

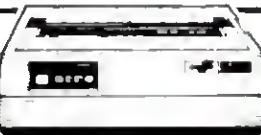


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The most advanced dot matrix printer in its price range.  
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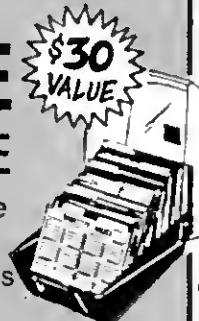
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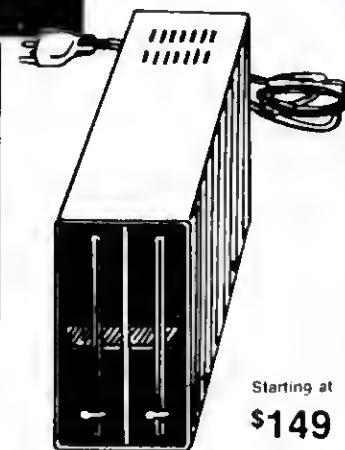
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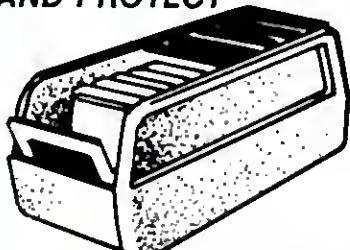
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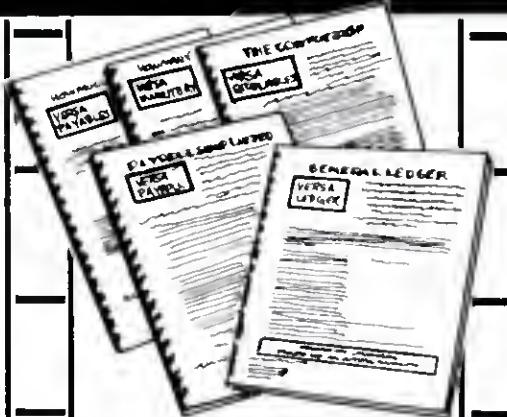
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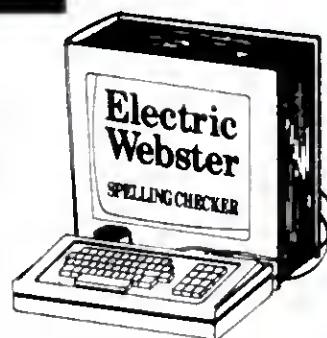
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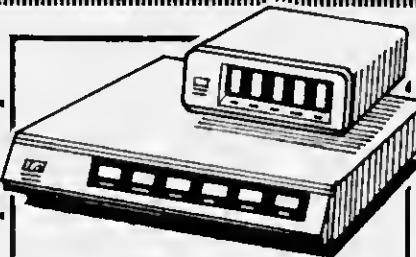
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## Lazy Writing

After many unsuccessful attempts at trying to get my Model 4 to use the spooler with Lazy Writer, I wrote to AlphaBit Communications, Inc. The solution, though not included in the manual, is simple. Copy the SYS-DRV/CMD file, found on the Lazy Writer disk, for 6.X.X to P1/CMD. When the spooler is operational, it's automatically used with Lazy Writer. I use this JCL file to activate the spooler:

```
1 SET *LM CLICK/FLT
2 FILTER *KI *LM
3 SPOOL *PR TO TEXTFILE:1 (MEM=5,
DISK=5)
4 L X1
5 //STOP
```

*Lance K. Mertz  
Snohomish Publishing Co.  
114 Ave. C  
Snohomish, WA 98290*

## Better Positioning

I merge this one-line utility with my programs to get each PRINT@ correct on first trial:

```
65000 X=PEEK(16416)+256*(3ANDPEEK
(16417)):PRINT@1016,X;" "@X,CHR$(14):;
Z=PEEK(14400):Z=2*Z:Z=Z/2:
PRINTCHR$(15):PRINT CHR$(-27*(Z=8
-26*(Z=16)-24*(Z=32)-25*(Z=64))):YS=
INKEY$:IFYS>=" "ANDYS>" "
ANDX<>1023THENPRINTYS$:GOTO
65000ELSE65000
```

You'll get a nondestructive cursor that you move with the arrow keys, while your program displays the position in the lower right corner. You can even use this as a screen editor since it accepts alphanumeric input.

*Thomas Eggarter*

*Chatadato Inc.  
Ramirez Mitchell 358  
5700 San Luis, Argentina*

## International Style

Daisy-wheel printer owners who type in foreign languages will be pleased to know that Radio Shack released a



daisy wheel, Scandia, that includes both Spanish and Danish characters. You access them via the SuperScritpsit System Code utility.

*Carlos Ortiz  
119-37 Metropolitan Ave. #30  
Kew Gardens, NY 11415*

## CLOADing

I'm able to run "Catacomb Conquest" (August 1984, p. 78) on my cassette-based Model III using "NODOS 80" (1983 Anniversary Issue, p. 96). Hopefully, "NODOS 80" will let me run other disk-based programs from 80 Micro.

*Norman Jennings  
1605 Walton Street  
Cornwall, Ontario  
Canada K6H 1W3*

Due to hardware interface problems, the bar code reader program originally scheduled for this issue has been delayed; we will publish the program as soon as we resolve these problems.

Also, because of Tandy's involvement with the Radio Shack showcases, Ask Tandy will not appear this month; the column will resume in February.

*—Eds.*

## For Geminis Only

Glenn Parkinson's FORMGEM ("Character Sketching," March 1984, p. 156) works perfectly on the Gemini-10X printer with only two changes. First, change the CHR\$(136) in line 1390 to CHR\$(8), and then change the CHR\$(132) in line 1430 to CHR\$(4).

*Mark Allen Reed  
Box 368  
West Lebanon, NH 03784*

I recently purchased Model 4 SuperScritpsit only to find that none of the printer drivers furnished with the program works with my Gemini-10X.

The drivers send a CHR\$(15) to the printer, resulting in condensed-mode printing. You can prevent this code from reaching the printer with forms filter. Type in these instructions at TRSDOS Ready:

```
SET *FF FORMS/FLT
FILTER *PR *FF
FORMS (XLATE = X'0F00')
SYSGEN (YES)
```

The first two lines set the forms filter, while the next line converts all CHR\$(15)s to CHR\$(0)s. The last line writes the configuration to disk, and the printer driver now works properly.

*Jerome D. Khutts  
Route 2, Speedway St.  
Campbell, MO 63933*

## Reader Aid

After unsuccessfully trying to run Model III graphics programs on the Model 4P, I realized that the Model 4P doesn't contain a Model III ROM. Because of this difference, the Model 4P prints incorrect graphics. Any suggestions?

*Jim Gonsalves Sr.  
2257 Manhattan Place  
Santa Clara, CA 95051*

*We had the same difficulty and found that POKE 16892,02 corrects this problem on the Model 4P.*

*—Eds.*

## READER EXCHANGE

Can anyone suggest a professional astrological program to run on a 48K Model III with twin double-density drives? The program should be able to print natal and harmonic charts.

*Roger G. Dawson  
22 Lancaster Road  
Preston, Lancashire  
England, PR1 1DA*

I'm looking for the automatic sequential dialer program that was first seen in the movie *War Games*. I've been told that its name is AMODEM-90 and that it's a public-domain program.

*Richard H. Epson  
1440 Sumner Ave.  
North Charleston, SC 29406*

I give up—how do I get to the last level in Deathmaze 5000? Also, I'm trying to locate a copy of a game program called Space Age 21.

*George D. Madison  
P.O. Box 649  
Winchester, OR 97495*

### Error Trap

In line 8 of "Double Trouble" (Reader Exchange, October 1984, p. 29) BACKUP SYS:0 should read BACKUP SYS0:0.

*Gil Seiler  
126 Boas Drive  
Santa Rosa, CA 95405*

*Incorporate this change in Alain Cirkovic's Easydata program ("Little Wonder," December 1984, p. 72) to get a directory in TRSDOS: Change Dir to D: in line 380.*

*—Eds.*

### DEBUG

Listed below are modifications to X-Mart ("Attention Shoppers," August 1984, p. 75) to eliminate the syntax error that occurs in line 290 when you try to exit the program. Delete line 1210 and make the following changes:

290 D1=LEFT\$(C3,X-2):D2=MID\$(C3,X,LEN(C3)-1):IFC3="QUIT" 1210 ELSEIF QH<>0 THEN 340

1210 PRINT@576, "SURE? ";:GOSUB 1300:IFN=0 THEN PRINTA:GOTO 280 ELSEIF = 1

Also, to eliminate two additional

bugs, change lines 710 and 740 to read:

710 IFC2="CAN" THEN IFJ=58 THEN IFE(38)=2 THEN PRINT DZ:PORT=1 TO 800: NEXT:E(38)=0:GOTO 800 ELSE=BELSEA=DELSEIFC2="POC" THEN IFE(21)=1 THEN IF(E(40)=2) THEN E(40)=0:I(40)=J:PRINT DZ:PORT=1 TO 800: NEXT:GOTO 800 ELSEA=BELSEA=D8

740 IFC2="WAL" THEN IF(E(5)=2) THEN E(5)=1:E(46)=1:I(5)=J:I(46)=J:A="YOU NOW HAVE AN"+B(5)+"AND A"+B(46):Q=Q+2 ELSEA=B

Finally, several readers have had problems after they have been ar-

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rested for jaywalking. After falling asleep they can move around, but can't manipulate objects. This isn't a bug! After moving around approximately 20 times, the player once again wakes up in jail. Because you're not actually playing during the dream, you can't manipulate items. Pay attention to the message that appears during the dream—it helps you escape from jail.

*Joshua Barinstein  
124647 Victory Blvd.  
N. Hollywood, CA 91606*

"The Direct Approach" (September 1984, p. 96) does work on the Model 4P, contrary to what's stated in the Key Box. Also, the following changes prevent garbage collection: Line 10010 should contain an OUT 132,142 immediately following the POKE, while line 10200 should contain an OUT 132,135 immediately following its POKE.

*Seth Monger  
4694 Coos Bay Wagon Road  
Roseburg, OR 97470*

Please note the following corrections for "Bugs from Outer Space" (March-August 1984). Line 100 of Text6B should read:

00100 ;\*\*\*\*PART6B

Change line 350 of TEXT6D to read:

00350 ERROR1 JP 7637H ;8637H for Mod3 TRSDOS

The buffer for adding scores to the scoreboard isn't properly closed. The Program Listing corrects this problem.

To assemble Text6E, load the completed game using System or Load, and then load Text6E. Save the complete game as described in the August 1984 issue (p. 88).

*Roger Smith  
505 Ridge Lake Road  
Crestview, FL 32536*

*Send correspondence to Reader Exchange, c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.*

*Program Listing. Correction to "Bugs from Outer Space."*

```

00100 ;****PART6E
00110 ;CORRECTS BUGS IN SCOREBOARD
00120 ORG 749AH ;849AH FOR MOD. III TRSOOS
749A CD1578 00130 CALL OOPS ;PATCH
7815 00140 ORG 7815H ;8815H FOR MOD. III TRSOOS
7815 D5 00150 OOPS PUSH DE ;SAVE DE
7816 3E20 00160 LD A.32 ;A=SPACE
7818 8606 00170 LD @,6 ;6 CHARACTERS
781A 12 00180 OOP10 LD (DE),A ;STORE SPACE
781B 13 00190 INC DE
781C 18FC 00200 DJNZ OOP10 ;LOOP
781E D1 00210 POP DE ;RESTORE
781F CD0362 00220 CALL 6203B ;7203H FOR MOD. III TRSOOS
7822 C9 00230 RET
0000 00240 END
00000 Total Errors
OOP10 781A
OOPS 7815

```

*End*

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# T/Maker: Functional CP/M Integration

by Eric Grevstad

The age of integrated software didn't begin with the IBM PC and Lotus 1-2-3. Since 1980, programmer Peter Roizen has been merging CP/M-80 applications into T/Maker, fitting the software concept of today with the hardware and operating system of yesterday. T/Maker includes word processing, spreadsheet, and data base management capabilities in one package.

The latest T/Maker (version 4.01) is no threat to new PC packages like Lotus' Symphony or Ashton-Tate's Framework, but the CP/M world has nothing else like it. If you have the patience to learn its syntax, T/Maker delivers genuinely flexible integration. It's an impressive piece of programming, as long as you don't compare it to dedicated word processors or spreadsheets.

## A Clean Slate

To give T/Maker a high compliment, it's as close to a blank sheet of paper as a Model 4 program can get. When you boot up the system, it presents you with a blank screen.

T/Maker has a switchable menu to execute its English-language commands and supplies on-line help for its sometimes cryptic keyboard functions. While the program may seem difficult to use at first, T/Maker tries to make things easy for you.

Don't be afraid when you open the box and five disks fall out. You'll need the first disk each time you start the program (and whenever you want help), but you'll do most of the work

edited by Ryan Davis-Wright



Illustration by Katherine Mahoney

with the second (editing, spreadsheet, data base, and printing) and third (list processing, graphics, and spelling checker with 15,000-word dictionary) disks. The fourth disk contains a 35,000-word auxiliary dictionary, and the fifth is a demonstration/tutorial.

Since T/Maker usually reserves drive B for data, you'll be swapping program disks in and out of drive A. Invoke a disk-3 command with disk 2 in the computer, and a "Command Failed: Nonexistent" message prompts you to try again.

You can change the data drive or other defaults with a program called TModify, which also lets you reconfigure the T/Maker keyboard rather than use its standard pattern, awkward for things like cursor movement.

Some of this has already been done for the Model 4/4P version. The arrow keys function and an addendum to the manual tells you how to emulate other CP/M terminals (the TRS-80's break key works the same as others' escape keys, and control-L replaces the

missing tab key). While T/Maker comes configured for 128K RAM and CP/M Plus, it also includes set-up instructions for Montezuma Micro's 64K CP/M 2.2.

## Commands And Conversations

While other programs prompt you with question marks, T/Maker's interface is a chatty "What Next?" You answer it with English commands: "Create" starts a new file and prompts you for a file name, and "Edit" brings you into the file. You can save time by entering commands together (Create Newfile Edit, or Align

Save Print It), though the instructions grow less grammatical as they grow more detailed; Print Nonstop From 10 To 30 It, for example, prints pages 10-30 of the current file without format queries.

Many of T/Maker's vital commands only work downward. A command to align or print text, for example, affects only the portion of the current (RAM-based) file below the top line shown on-screen. In most cases, you'll either move to the top of the file beforehand or use T/Maker's framing command, which is similar to a spreadsheet's ability to freeze a column of labels while viewing other data.

T/Maker's most important command, though, doesn't directly affect anything. Edit (E) removes the "What Next?" prompt and activates T/Maker's editor, the heart of the T/Maker system. It's a free-form program that lets you put anything you want anywhere on the screen, but it's a slight exaggeration to call it a word processor.

You create every T/Maker file, whether it's a document, spreadsheet, or data base, through its editor.

As mentioned, the editing screen is initially blank. Pressing break and then the ? key calls up a status line that indicates the current file's name, length, free space, current cursor position, and carriage-return mode. (To explain the last, break-R rotates among manual returns, word wrap after 63 characters, and spreadsheet-style horizontal scrolling, while break-

search and search-and-replace functions (break-' and break-'' respectively) are fast and accurate.

#### Words Under Wedges

Oddest of all is T/Maker's approach to margin setting and justification. Instead of embedding commands or keystroke sequences, you set line width by typing in pairs of wedges (<< >>) delimiting text boundaries. The wedges shape the text below until T/Maker encounters the next set of wedges. Minor changes, such as a right wedge of ->> versus >>, yield justified, ragged, or centered copy for block-style or indented paragraphs.

T/Maker doesn't format text until you leave the editor and use the Align command, which reads the wedges and adjusts the text accordingly. It also runs paragraphs together unless there's a blank line or a single period between them, turns columnar tables into prose if you forget the "do not align" wedges (>> <<), and puts two spaces after question marks, exclamation points, and periods (including the one in Mr. Jones).

While T/Maker's word processing features make you long for Scripsit, its spelling checker is quite good, in an odd sort of T/Maker way. Entering the Proof command (with the first line of your file at the top of the screen) produces a handy table tallying the file's total number of words, unique and unfamiliar words, and the average number of characters per word and words per sentence.

When you return to the editor, you'll not only find the unrecognized words tagged in your file but a double list, with two copies of each offending word per line, appended to it. Fix the second sample of each word and it'll be changed throughout your file when you issue the Correct command, or added to the dictionary with Amend. You can even ask for help, changing the second sample to something ambiguous like "rhy?hm" and asking T/Maker to spell it.

#### Monster Math

I also like T/Maker's skill with lists and tables. Once you learn the lingo, it sorts and shuffles columns of data easily and quickly. If the first item is at the top of the screen, the command Sort A N 12 32 puts the numbers in columns 12-32 in ascending order.

You could also sort a list of characters, or sort in descending order.

A similar command, Tally, is more explicitly mathematical. It takes lists (files with plus signs in the first column of each line), breaks them into categories by column number and, if you want, sums the numeric values associated with them. For example, I could tally the second and third columns of a list of dinner guests, their sex and their ages, and learn there were three males and four females, with combined ages of 82 and 103, respectively.

The further you get into mathematical work, though, the more T/Maker's word-based structure hinders you. It works best with vertical lists. With plus and minus signs running down the left margin and an equals sign at the bottom, the Compute command can solve the list as if it were an algebra problem.

Beyond this, you're into T/Maker's spreadsheet. Like its other program features, the spreadsheet is great at merging data into business letters but terribly difficult to master. If you can imagine a word processor with no Delete Word function, imagine a spreadsheet with no cells, parentheses, or automatic recalculation for "what-if" changes.

T/Maker's way of defining column widths (up to 50 computable columns) isn't necessarily bad. The top line of a spreadsheet is an example line (labelled "ex") and contains maximum width numbers such as 99,999.99. Any numbers below them, even if not perfectly lined up, will be realigned to match the examples (with or without commas, and with the same number of decimal places).

The rest is like VisiCalc in reverse Polish notation. All mathematical functions (from + and / to exp and abs) appear not in row and column intersections, but externally, running down the left side or across rows atop or between spreadsheet entries. This system works for simple sums, but calculating a specific cell without anything like a cell formula is murderous.

In addition, T/Maker doesn't use parentheses. Its inflexible method of operation is to do all additions, subtractions, multiplications, and divisions in that order. To overcome this, you must sprinkle the spreadsheet with instructions: ac1 (first step, compute for all subsequent rows), jc2 (second,

### T/Maker Integrated Software



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Easy to use? ★ ★ ★ ★ ★  
Good docs? ★ ★ ★ ★ ★  
Bug free? ★ ★ ★ ★ ★  
Does the job? ★ ★ ★ ★ ★

I toggles an insert mode. A ruler below the status line helps you set margins and tabs.)

Running under Model 4 CP/M, the editor suffers from poor typing response and keybounce (if I were using it to write this, it'd be a review of Tt/Mmaker) and it lacks some useful functions, such as cursor movement that wraps around lines or a way to delete words as well as characters. There are no true block-move operations, but you can copy lines one at a time into a 40-line buffer for movement (first in, first out) elsewhere.

On the positive side, the editor's embedded print commands are convenient: ".single" and ".double" control line spacing, and ".newpages" starts a new page if fewer than five lines are left on the current one. Footnotes are handled automatically, and

just compute for the next row), rc3 (third, rarely compute only on subsequent rows derived from other rows).

After studying the manual's examples and typing them in, I'll admit that T/Maker's spreadsheet can do some sophisticated things, such as built-in notations for functions like growth rate and rounding interim values. But doing them requires learning a whole new approach (even stranger than dBase II language) that applies to no other spreadsheet on the market. The system almost requires enough pre-planning with pencil and paper to defeat the whole purpose of spreadsheet work.

### Keeping Records

Clearly, the spreadsheet is T/Maker's worst feature. I'm a lot happier with its data base manager which, while requiring similar pains in setting up, performs swiftly and capably once the job is done.

The data base, as you'd expect, is a text file created with the editor. It begins with sections (<form>...<end> and <record>...<end>) describing how a record will appear on the screen and how T/Maker will file it. A record can have up to 120 fields of 80 characters apiece, with field lengths defined by curly braces (left-shift/@ and right-shift/@ on the Model 4 keyboard).

Once you define a data base, the Update command works much like the regular editor, letting you review or alter records one at a time (the search function for individual items is unchanged, the "next word" cursor movement command becomes "next record"). As with lists, you can rearrange a data base alphabetically or numerically, in ascending or descending order.

For more precise work, the Select command finds groups of records easily. Altering all the records in a data base is as easy as reentering the file, changing the form and record definitions, and adding another definition for use with the Set command (such as Status = Prime When Income > \$50,000).

T/Maker is no R:Base or Profile, but its data base is a nice variation on the text-oriented theme. When using Update, for example, the break-? status line changes from an editing ruler to an indication of how many more

records of the current length can fit in a file.

### Mixed Impressions

There are other good things about T/Maker. While it doesn't have windows, the List command lets you look at a second file without losing the current one in RAM. It's a breeze to chain, merge, and insert different files of different types for printing (one print command strips away ugly example and instruction lines from the spreadsheet).

The command menu is handy for beginners, though users will soon skip it in favor of stringing together multi-word commands. The help screens are excellent: well-organized, well-written, and valuable even to seasoned users who haven't used a particular function in a while.

And the documentation is first-rate. There is a superbly organized 400-page manual and two reference booklets, as helpful and readable as anything I've seen in some time. It's relevant to remember that T/Maker has been around since 1980, gathering a group of hardcore fans. It's not only thoroughly debugged, but thoroughly documented.

I also used T/Maker on the Tandy 2000, and liked it better on that machine than on the Model 4. It was considerably faster, not so much in terms of commands like Align (for which T/Maker goes to disk) but in terms of general feel and responsiveness. The 2000 T/Maker has a full invaluable implementation of function keys: PgDn sure beats break/control-P for "move to end of line."

Is T/Maker worth \$450? It's certainly worth the increase from the prior version, T/Maker III (still available at \$275, but with no spelling checker, no data base, and no on-line help). It does look good when you compare its cost to several separate programs, which aren't able to merge or create such versatile files. And none can compare to its blank-paper approach only now being seen in MS-DOS products like Aura and Enable. On the other hand, the standalone programs beat T/Maker's performance in some vital areas.

T/Maker is an extremely versatile, somewhat awkward text editor with fast and intelligent search functions and limited mathematical capabilities.

If Framework is the sleek new Porsche of integrated software, T/Maker is an old Plymouth Road Runner with a big V-8 and a bad clutch. While it may be inefficient and hard to maneuver around town, it has great power and performance on the straightaway.

I wouldn't choose T/Maker's editor over a real word processor and I wouldn't choose its spreadsheet at gunpoint, but it's the closest thing to real integration that CP/M will ever see. It is certainly worth considering. If you only want to learn one set of commands, it's worth using. ■

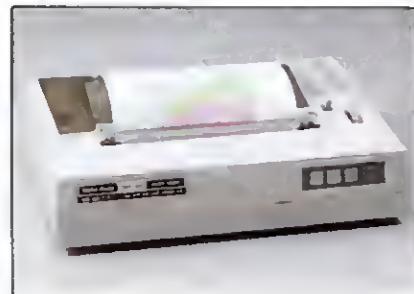


Photo. The CGP-220 printer.

### Color Me Beautiful: Radio Shack's CGP-220 Color Printer

by Bradford N. Dixoo  
80 Micro Technical Editor

Radio Shack's CGP-220 ink jet printer is compact, quiet, and colorful. But the CGP's most remarkable feature is its low price: For \$699, home computerists and small-business users can get high-quality color printouts of screen graphics.

The CGP-220 is compact (15 1/4 by 11 5/8 by 4 1/4 inches) and lightweight, weighing only a little over 12 lbs. It has a spare and uncluttered design, with the operating switches on the unit's right front side. The Ready, Alert, and Power indicators are also located there. The Reset, Paper Feed and On/Off line switches are touch sensitive, lying flat on the front.

The slots for the ink jet's color and black ink packets are hidden from view by a door on the front. The ink packets come inside plastic cartridges so you never handle the ink. On the left, underneath the paper cover, is the ink pump. Before you can do any printing, you have to prime the ink jets with a few short pushes on the green pump lever.

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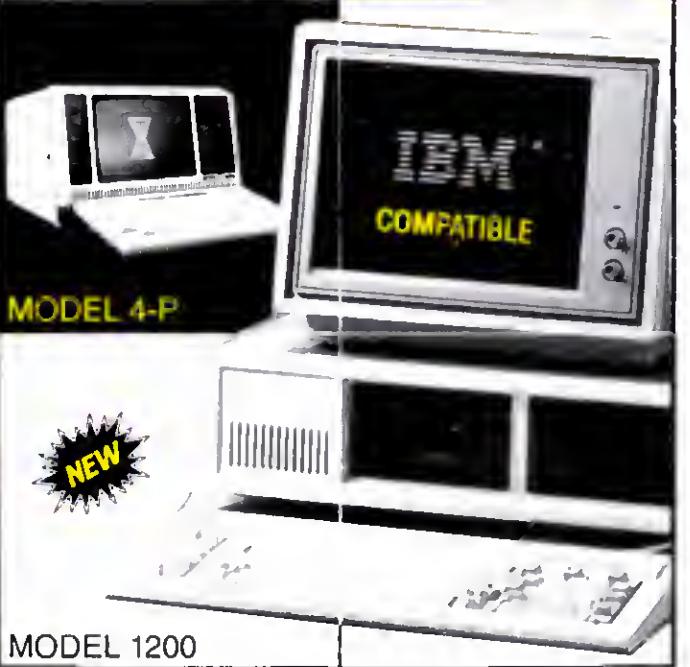
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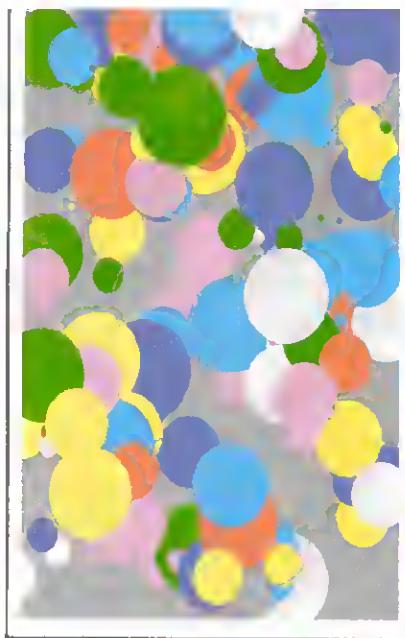


Figure 1. The CGP-220 took about three minutes to make this screen dump graphic.

The power cord connector is on the back, with parallel and serial interface connectors, as well as a 600-/2,400-baud switch.

#### Features and Performance

After you're acquainted with the machine and have inserted one of the three sheets of paper included with it, you can start printing. While the print

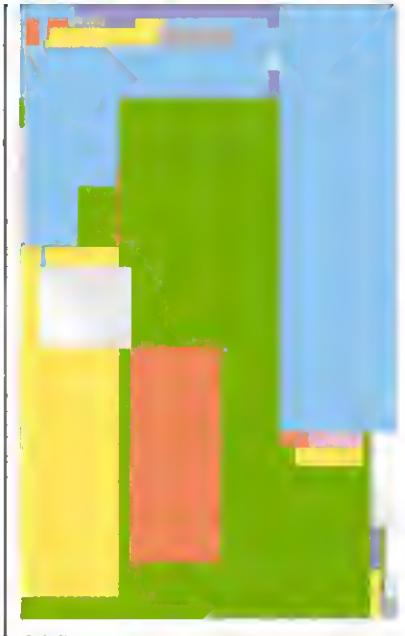


Figure 2. All the designs were printed clearly, with no color bleeding.

speed is an unimpressive 37 characters per second (for the full ASCII and special-character sets) this is of little importance, since you'll probably use the machine almost exclusively for graphics. In the graphics mode, the CGP-220 moves along at 2,630 dots per second and features bidirectional scanning. The printout in Fig. 1. took about three minutes to produce.

The ink jet prints in seven colors (black, red, green, blue, yellow, magenta, and violet) by mixing the yellow, magenta, and cyan base colors from the color packet cartridge. Even the most demanding designs are clear and sharp, and none exhibit color bleeding (see Fig. 2).

The quality of the paper used to produce the screen printouts makes a lot of difference in its final appearance. The CGP-220 will print on cut sheets or on roll paper, but not on form-feed paper. Radio Shack sells roll paper (catalog number 26-1333, three rolls for \$9.95) and single sheets (catalog number 26-1341, 250 sheets for \$6.95) for the ink jet printer. While I tried other types of stock, including high-quality bond paper, photocopy machine paper, form-feed paper (without the pin holes), and special paper from a Diablo ink jet printer, the Radio Shack paper produced the best results.

#### Using the CGP-220

The easiest way to use the ink jet printer is in the text mode, the default mode at power-up. You select the color of print desired and whether you want normal or elongated characters as the print style. You can issue print commands in all print modes from Basic without the cumbersome use of DIP switches inside the printer.

While print quality in the text mode isn't as good as Radio Shack's other dot-matrix printers, it is readable.

The CGP-220 was made to create graphics and in that capacity it performs superbly. When you use it with Tandy's Model 2000, which has one of the best screens available for color graphics, you lose virtually none of the resolution in transferring a picture from the screen to paper. Although there are differences in color because of code incompatibilities in the computer and the printer, you can avoid these with careful programming.

The MS-DOS disk that comes with

the Model 2000 contains a screen dump program for the color printer (CGPDMP.BIN) which you call from Basic when you want a screen dump. On Radio Shack's Color Computer, another screen dump program is available that transfers intricate designs from the CoCo's screen onto paper.

CGP-220 users don't have to use a Model 2000 or a CoCo to get a lot out of the printer. Programmers using the Models 1, III, or 4 can also take advantage of color graphics by programming the printer directly from Basic in the CGP-220's bit-image mode or the color-scan mode.

The bit-image mode lets you address each of the 640 horizontal dots per line and seven vertical dots to produce colorful designs and business

#### CGP-220 Color Printer



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Easy to use?	★ ★ ★ ★
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Does the job?	★ ★ ★ ★

graphics without a color computer. Of course, the biggest drawback to using one of Radio Shack's non-color computers is that you can't see what you're creating until it's printed. Another disadvantage of using a Model III or 4 with the CGP-220 is that you can't use the screen dump command to produce hardcopy because the character set in the printer does not recognize TRS-80 block graphics. If you press the shift/down-arrow/asterisk key combination on a Model III, any block graphics on the screen will appear as periods on the CGP-220.

The color-scan mode on the ink jet printer is similar to the bit-image mode, but allows for greater manipu-

lation of color. This mode uses large amounts of memory, however, and programming in it is difficult from Basic.

#### The Documentation

The printer's manual makes using the machine effortless. It's well-written and easy to understand, with examples to illustrate the CGPs capabilities.

The manual's lengthy table of contents directs you to areas that describe advanced features without searching through the 52-page book. Separate chapters in the manual describe the process of color printing, setting up the printer, descriptions of the various control codes, and lessons on the three kinds of printing available with the CGP-220.

Radio Shack also provides extensive appendices with additional programming tips, care and maintenance sug-

*While the text quality isn't outstanding, it's adequate as dot-matrix printers go.*

gestions, troubleshooting aids, and schematic diagrams of the machine. Any user can get the most out of the manual whether a novice or a seasoned programmer.

#### Conclusions

With a machine like this, you'll want to try out different color combinations and graphics. The CGP-220's ink cartridges let you print up to 4 million characters before you have to replace them. Replacement ink cartridges cost \$9.95 for the black ink pack and \$14.95 for the tri-color. I've used the CGP-220 for many complex screen shots for three months and still have plenty of ink left.

While the text quality isn't outstanding, it's adequate as dot-matrix printers go. In terms of the graphics this machine produces, it's tough to beat for the price. Radio Shack has the CGP-220 listed with their Model 100 and Model 2000 as part of their Advanced Technology Series of products. ■

## Programming with The Producer

by Hardin Brothers

**T**he Producer won't land you a job in Hollywood, but it will let you create your own Basic data-handling programs with a minimum of bother. Even if you know nothing about programming, you can develop your own powerful data base managers. And if you're only moderately skilled in Basic, The Producer will create working program modules that you can easily add to your own software.

The longer I used The Producer, the more impressed I was. After only one month, it had found a place among my most-often-used software.

#### Using The Producer

The Producer comes in a hefty package that includes the documentation (several hundred pages) in a three-ring binder with reference dividers; a sample evaluation disk; the master disks, which include automatic back-up routines; and a three-hour cassette tutorial, which helps you through any rough places in the documentation.

The easiest way to explain how The Producer works is to describe how you would use it to create a data-handling program. When you boot up the Producer's master disk, an Auto program reserves some high-memory space and runs the main program. When the menu comes up, you turn on the printer, press the A and I keys, and print a planning form.

Using the form, you pick the program's name, state its main purpose, list the fields you want included in each record, and make any calculations that your program will apply to those fields.

Then return to the main menu, format a disk, and start to define your program. The Producer comes with a stripped-down version of DOSPLUS 3.4 that you must use to create the program, although you can transfer the completed program to any DOS.

The Producer includes a more-than-adequate editor to create an input screen for your program. You can mix graphics and text, and add large-font letters, borders, message areas, and field areas.

When you're satisfied with the screen's appearance, The Producer

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<b>Does the job?</b>	★ ★ ★ ★ ★

translates it into lines of Basic and then goes to a screen definition mode. It asks you to define the location and length of each of your fields, as well as the characters allowed for input for each. You must also define an area for The Producer to use for messages. There is an optional custom prompt area in which you can display messages that will help the program's operator respond to each field question.

After you draw and define the screen, you enter a mode called Edit Basic Data. Here you can create custom prompts for each of the fields defined earlier. These prompts will appear either when the program's user begins to enter data in each field or when he presses the clear key; the choice is yours.

Also, while in the edit mode, you define the calculations to be used on the numeric data in various fields. You may decide to either save the results of the calculations along with the rest of the information in each record or display the results for the user's benefit.

#### The First Draft

Finally, you're ready to create the first draft of the finished program. One of the selections from the main

*Continued on p. 160*



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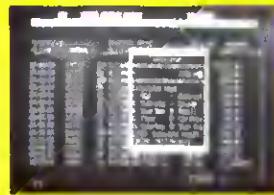
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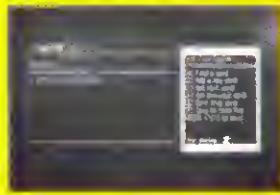


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# Running Like the Wind

by Thomas L. Quindry

**80's own Basic compiler is back and better than ever—it compiles more Basic commands and it's easier to use than our original version, and it now runs under any Model I/III DOS.**

**A**fter hours of painstaking programming and debugging, you've come up with the ultimate arcade game—The Flying Slim Whitman Records—where you try to blast away the disks as they speed past you; "Una Paloma Blanca" garners a 500-point bonus. But when you run the program, the records move more slowly than they did up the *Billboard* charts.

Your problem lies with the way Basic executes program instructions: The Basic interpreter breaks down program statements into machine-language commands before executing them. You can circumvent this time-consuming process by running your program through a Basic compiler, a program that converts Basic statements to machine code. Since the compiler does some of the work of the Basic interpreter, the resultant program runs faster.

I wrote an enhanced version of Dr. Dimitri P. Bertsekas's Basic compiler ("A Basic Compiler in Basic," October 1982, p. 122). My version, which I call FastBas, compiles more Basic commands, is easier to use, and runs under any DOS on the Models I and III. (For a comparison of FastBas with commercial compilers, see the sidebar.)

When FastBas converts Basic programs to machine language subroutines, programs run faster. Programs that use primarily integer arithmetic and graphics run 50-100 times faster, while programs written mostly in single-precision variables execute 3-20 times faster.

The programs you're compiling must stringently follow Basic programming rules for correct compilation. FastBas doesn't accept all Basic commands, but all compilable commands run in Basic. I

suggest running and debugging your program in Basic, then compiling it.

## Compiler Basics

To understand how Basic compilers work and how they increase execution speed, you must first understand how your TRS-80 handles programming functions.

The TRS-80 ROM contains a machine-language program that interprets Basic programs line by line. If you run a line 1,000 times during the course of a program, the machine-language program interprets the statements in that line 1,000 times.

The Basic interpreter calls specific machine-language subroutines in ROM for each statement. Because of the extensive error-checking that takes place during this process, the program runs slow compared to machine-language programs.

A compiler, on the other hand, looks at each Basic statement once. It interprets the statement, then writes a machine-language subroutine for it and stores that subroutine in memory. The compiler then interprets the next statement and puts the machine-language subroutine in memory after the previous subroutine. Once the compiler changes all Basic statements to machine-language subroutines, you can save and run the compiled program.

How much faster compiled programs run varies with the nature of the program. Compiled programs still contain many inefficiencies in coding relative to bona fide machine-language programs.

## Program Changes

I rewrote as few lines of the original program as possible and didn't renom-

ber it so that readers who have keyed in the original can modify their programs.

Lines 0-500 in Program Listing 1 contain a sample Basic program for you to compile. Note that the last line compiled must be an End statement.

Many of FastBas's subroutines appear before the main program to speed up compilation. The main program starts at line 1000.

Most of the statements I added are string functions. FastBas can compile the Basic commands to input a string value, and then find a string's VARPTR, ASC, and VAL. The program also interprets string concatenation (addition), and redefines strings from other string values. It also accepts Dimension (DIM) and Clear statements (see Tables I-4 for a complete list of compilable statements and functions).

Program Listing 2 uses the string Input function and the ASCII (ASC) function to let you answer yes/no questions. The ASCII function finds the ASCII value of the first character of the input string and acts on it using If statements.

This program also exemplifies the use of the Dimension and Clear functions. FastBas accepts only one Dimension statement in the first line of the program you're compiling. You can, however, precede Dimension with a Clear statement, as in line 10.

For best results, put Clear and Dimension on a line separate from other program statements. Also, you can't GOTO the line containing the Dimension statement from within a compiled program.

Listing 2 also shows you how to use the Dimension statement in both Basic and compiled programs. The Dimension statement sets up the variable storage table and tells you how many of

each type of variable exist. In this sample, DIM A\$(40) tells the compiler that the program uses one string, A\$, and that the maximum string length is 40 characters. The equivalent statement in Basic (Run) sets up a string array with a dimension of 40.

Although Basic doesn't need a 40-string array, setting one up doesn't affect program execution, and you can test the Basic version before compiling it.

Program Listing 3 demonstrates how to use VARPTR (variable pointer) with PEEK and POKE commands to simulate uncompliable Length (LEN) and LEFT\$ functions. By using substitute programming techniques, you can simulate other uncompliable functions, such as RIGHT\$ and MID\$.

The VARPTR function identifies the memory location of each string used. As in Basic, the VARPTR function for strings points to a 3-byte table that gives the length of the string in the first byte and the location of the string in the next 2 bytes.

No specific string variable table exists for FastBas, so VARPTR creates a table for the requested string. FastBas always stores the table below the variable buffer in memory.

VARPTR moves the correct string length and location values to the 3-byte table. Only one VARPTR location is active at a time. Once the program in Listing 3 obtains the VARPTR, it stores the values at the VARPTR location in other variables before seeking another string location.

The Clear command clears all variables to zero. It's not needed at the beginning of the program you're compiling, since FastBas automatically zeros the variable storage area.

If you don't want variables automatically zeroed, make the USR call to your

compiled program 13 bytes higher than specified in the addresses given after compilation. This lets you compile several machine-language subroutines that the USR function calls from your Basic program. Each subroutine can then use the previously defined variables.

You can put the Clear command anywhere in the program you're compiling. FastBas ignores any digits after the Clear statement up to the colon or end of the program line (whichever comes first), but you can include them if they're necessary to run the uncompiled program. For instance, "Clear 200;" in the compiled program gives the same results as "Clear;" in the Basic version.

### Compiling Basic Variables

FastBas accepts three variable types—integers, single-precision, and string variables—and you can't do much variable mixing. When using integer variables, the only way to include single-precision variables in the same statement is to use the integer (INT) function. FastBas allows only addition and subtraction with integer variables.

You must first define the values acted on within the functions PEEK, POKE, VARPTR, ASC, VAL, and so on as integer variables or integer numbers without using arithmetic operations. The values must be integer variables or integer numbers between -32767 and 32767 without arithmetic operations.

FastBas can perform close to a full set of mathematical operations with single-precision variables. This includes the four basic math functions plus exponents, logarithms, random numbers, trigonometric functions, and so on.

The hierarchy of FastBas's mathematical operations is not as sophisticated as in Basic. The order of a Basic mathematical evaluation is exponentiation, followed by multiplication and division, then addition and subtraction.

FastBas evaluates operations from right to left, using the order of parentheses. This simplified system speeds compilation, but requires careful use of

General Statements	Description
Clear	Integer value is optional
CLS	Clears screen
DIM	Same syntax as Basic except for strings (see text)
END	Mandatory statement to return to Basic from USR subroutine
GOSUB (line number)	
GOTO (line number)	
REM or '	
RETURN	

Table 1. General statements that can be compiled.

### The Key Box



Models 1 and III  
32K RAM Disk Basic  
Cassette Basic

# Basic Compiler Comparison

by Hardin Brothers

Compiler	Fast Bas	Accel 3/4	Bascom	Vivace!	WIBASIC	ZBasic 3.0
Available for Models	I/III All DOSes.	I/III All DOSes.	III/4; only supported on TRSDOS but appears to work with other DOSes.	III/4 TRSDOS only.	I/III All DOSes.	I/III/4; all DOSes plus Apple, IBM-PC, Model 2000, Lobo & CP/M80.
Source File Location	Lines 1-500 of compiler program.	In memory with Accel and Disk Basic.	On disk as an ASCII file.	On disk as a tokenized file.	In memory with WIBASIC compiler and interpreter.	In memory with ZBasic compiler & editor or on disk in tokenized form.
Compile to	Memory only.	Memory only.	Disk /REL file, then linked into a CMD file.	Disk file.	Memory or disk.	Memory or disk.
Compatible with Disk Basic	Moderate. Supports integer and single-precision only. Several commands not supported.	Complete. Compiles only those commands it can optimize. Leaves others for Basic interpreter.	Very high, with a few minor differences.	Complete, though the Model III version had sporadic problems with file commands.	Uses its own version of integer Basic that is different from TRS-80 Basic, especially error-trapping and file-handling.	Uses its own version of Basic that is similar to Disk Basic, plus extra commands including structured loops (Repeat/Until & While/Wend) and graphics commands.
Location of runtime? library	All necessary code compiled into each command.	Separate disk file.	Separate disk file.	Separate disk file.	Compiled into CMD program.	Compiled into CMD program.
Chaining with common variables	No program chaining possible.	Chaining possible but no variables can be passed.	Chaining with any or all variables passed.	Model 4 only.	Possible, but requires tricky programming.	Can merge source programs, can't chain.
Speed of compiled program †	Moderately fast.	Moderately fast.	Very fast.	Relatively slow. Model 4 version was slower than original Basic program in benchmark test.	Very fast.	Fastest of all compilers in benchmark tests.
Ease of use	Moderately easy to use.	Easiest to use and understand.	Several options in both compiler and linker can cause confusion at first. Compiled program can be easily linked to Fortran and MACRO-80 programs.	Easy to use except I found the program sometimes had difficulty reading its own protected disk.	Compiling is easy but programs can be difficult to develop because of differences between Basic and WIBASIC.	Easy to use and understand. Most differences between Basic and ZBasic are enhancements, and the syntax feels "normal."
Other Comments	Best choice for developing USR routines for your Basic programs.	Best feature is its ease of use. Requires both a runtime library and Disk Basic to run CMD program.	All math functions can be double-precision. Best choice for very large and complex programs that require chaining.	Supplied on protected disk. Slow execution speed of compiled programs. I found erratic bugs in both the compiler and completed programs.	Compiled programs are very fast. Requires learning a completely new version of Basic.	Speed of compiled programs and power of extensions to Basic make this a top choice for programs that do not require chaining. Source code compatibility with other computers may be a major asset for some.
Supplier & Cost	This issue of <i>80 Micro</i> & Load 80	Allen Gelder Software \$99.95	Radio Shack \$195	WittSoft, Inc. \$49.95	WittSoft, Inc. \$49.95	Simutek Computer Products \$89.95

† Benchmark used for compilers except Fast Bas was a combination of all programs in "Marking Time" (May 1984, p. 100). Programs were run compiled and uncompiled under various DOSes and versions of Disk Basic.

parentheses for proper evaluation. The use of parentheses doesn't slow compiled programs.

The compiler accepts 26 integer variables, denoted A%-Z%, and 286 sim-

ple single-precision variables, denoted by A-Z, or by a letter followed by a single decimal digit. Possible simple single-precision variables are A, A0-A9, B, B0-B9, . . . Z, Z0-Z9.

You can represent one- and two-dimensional arrays using the letters A-Z. Two-dimensional arrays must be square. For example, array B with dimensions B(34,34) is acceptable, but B(34,35) is not.

Denote string variables using A\$-Z\$. The maximum length for each string is the same. The program uses the same maximum length for string literals in Print statements.

If FastBas doesn't find a Dimension statement in the first line of your program, it uses default values for all variables (see line 1010 of Listing 1). Regardless of the dimension, FastBas has a minimum of integer and single-precision values from A%-Z% and A, A0-Z, Z0, respectively.

The Dimension statement doesn't have to include all types of variables. FastBas zeros variables not included, in the case of arrays, or takes minimum values. The minimum simple single-precision variable value is a letter from A-Z.

The compiler sets strings A\$-Z\$ to a character length of 40 unless otherwise specified in the Dimension statement. I recommend that the string length remain at a minimum of 40 so you can use print statements in your program. You can specify a minimum of one string, A\$, with the Dimension statement.

You can dimension more than one variable of each type in one Dimension statement. This is so the equivalent Basic program doesn't cause an error.

Only the last variable specification of each type sets the maximum dimension. For instance, Dimension C(20,20), B(2,2) is permissible, although in the compiled program, the maximum two-dimensional array is B(2,2).

The program hasn't saved enough space to store the C array. Changing the Dimension statement so it compiles to Dimension B(2,2), C(20,20) saves space for both arrays. This is important, since FastBas doesn't check for illegal arrays.

FastBas doesn't error-check variables, either. This can produce problems or work to your advantage. In the case of the defaulted variable values, the program has reserved memory for one-dimensional and two-dimensional arrays.

FastBas stores all arrays sequentially and computes the location of each array value. You'll probably dimension the maximum array location to 20, but you can define larger arrays.

You can include an array with a max-

Integer Statements	Description
+	The only math operations allowed with integer variables.
Example: A% = A% + B% = 7	
For...To...Next	Requires integer variable or integer number. Follow Next with the specified integer.
Example: FOR N% = A% TO B%:...:NEXT N%	
	FOR N% = A% TO 10:...:NEXT N%
If...Then (Line number) Else	Any combination of =, <, > conditions are valid.
Replace Then with GOTO or Then GOTO. Only specify line numbers after Then or GOTO. Any number of If...Then...Else statements can follow each other.	
Example: IF A% > = B% GOTO 400	
	IF A% > = 45 GOTO 400
	ELSE IF A% < 30 GOTO 400
Input	Don't include strings in quotation marks.
Example: Input A%	
INT	Changes single-precision expression to integer expression. Computed value of single-precision expression must be between -32767 and 32767.
Example: A% = INT(R*256 - 65536)	
Let	Optional. You can only define integer variables to an expression that includes single-precision when using INT.
Example: LET A% = B%	
	A% = B%
PEEK	Requires integer variable or integer number.
Mathematical operations are not acceptable.	
Example: A% = PEEK(A%)	
	A% = PEEK(-450)
Point	Same as PEEK. Integers must be between 0 and 127, and 0 and 47 respectively.
Example: A% = POINT(C%,34)	
	A% = POINT(23,34)
POKE	Same as PEEK. Second Integer must be between 0 and 255.
Example: POKE A%,B%	
	POKE - 3445,B%
	POKE - 3445,45
Print	You can mix integers, single precision, and strings, as well as messages between quotes.
Example: PRINT "The answer is ";A%	
	PRINT A%;B%;" ";SS
PRINT@	Location is integer variable or integer number between 0 and 1023. Otherwise same as Print.
Example: PRINT@C%."The answer is ";A%	
	PRINT@320,A%;B%;" ";SS
Reset	Same as PEEK and Point.
Example: RESET(C%,34)	
	RESET(23,34)
Set	Same as PEEK.
Example: SET(C%,34)	
	SET(23,34)

Table 2. Integer statements that can be compiled. Integer statements except Let require definition to an integer variable and can't include math operations. They must be between -32767 and 32767.

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imum dimension of A(60) in your program if you don't use arrays B and C. FastBas specifies the maximum letter for arrays as at least C, so dimensioning Z(20) accommodates a single array of A(520) just as easily as dimensioning

A(520). An example of this appears in the sample program in Listing 1.

The added commands for string input and for string concatenation don't check for string length. However, the original string definition function does

check, so the same rules apply as for arrays. If you expect a string to be twice as long as allocated due to these functions, don't use the next higher string variable.

### Passing Variables

Two special functions, DEFUSR and USR, pass variables from Basic to a machine-language subroutine and back. You can use them to speed up a Basic program by having only part of it compile into a machine-language USR subroutine (see sample program in Listing 1).

A Basic program that calls the compiled subroutine starts at Line 10000. Line 10060 calls the machine-language subroutine compiled from lines 0-500. FastBas's DEFUSR function is in line 1310. Note that you must dimension the Basic portion of the program sufficiently when arrays pass back from the machine-language subroutine to Basic.

If the If statement condition has executed the Clear 50 command in line 1316, running the sample program (by pressing the enter key) results in the error message "Subscript out of range" in line 1340. To run the program, press the break key and type in RUN 10000.

Line 30 in the sample program instructs the compiler to write code to pass the variable N% to the USR subroutine using the statement N% = 0 + N%. Line 40 transfers the value of the A array in the same fashion.

After the USR subroutine performs its function, the redefined A array transfers back to Basic in line 140 by A(1%) = 1 \* A(1%).

The values of the variables on the right side of each equation are from lines 10000-10090 in the uncompiled Basic part of the program. They don't have to be the same variable name as on the left of the equals sign in lines 30, 40, and 140, but I recommend using identical variable names to assure complete compatibility with the uncompiled program. To try the program in Basic, change line 10060 to GOSUB 30 and change line 500 to RETURN.

### Manipulations in Memory

FastBas doesn't compile in a fixed memory location, but determines where protected memory begins and compiles from that point. If the program exceeds memory limits, it lowers the high memory pointer (H)MEM) by 512 bytes and restarts compilation. This process

Single-precision Commands	Description
+, -, *, /, and   (exponent)	Accepted math operations. Can include single-precision expressions with integer variables. Placement of parentheses is important. Example: A = A% * B - ((C/7)[2]
ABS	Can use single-precision expressions, single-precision variables, or integer variables in parentheses. Example: A = ABS(4*B% - 76)
ATN	Same as ABS. Example: A = ATN(4*B% - 76)
COS	Same as ABS. Example: A = COS(4*B% - 76)
EXP	Same as ABS. Example: A = EXP(4*B% - 76)
If...Then (Line number) Else	Any combination of =, <, > conditions are valid. Can replace Then with GOTO or Then GOTO. Only specify line numbers after Then or GOTO. Any number of If...Then...Else statements can follow each other. If first value is an integer variable, it must follow rules for integers. Example: IF A > = B% GOTO 400 IF A > = 45*3 GOTO 400 ELSE IF A < CGOTO 400 IF A > = 45*3 THEN 400 ELSE IF A < C THEN 400
Input	Don't put quotation marks around string expressions in Input commands. Example: Input A
Let	Optional command. Can define single-precision variables to an expression that includes integer expressions. Don't include integer commands in the expression, only integer variables and single-precision variables and expressions. Placement of parentheses crucial for correct evaluation. Example: A = 50 + TAN(355/(113*4)) + (A% * 256)
LOG	Same as ABS. Example: A = LOG(4*B% - 76)
Print	Same as integer Print. (Table 2)
PRINT@	Same as integer PRINT@. (Table 2)
RND(0)	Random number greater than 0 and less than 1. Example: A = RND(0)*10
SIN	Same as ABS. Example: A = SIN(4*B% - 76)
SQR	Same as ABS. Example: A = SQR(4*B% - 76)
TAN	Same as ABS. Example: A = TAN(4*B% - 76)

Table 3. Single-precision functions that can be compiled. These functions can use math operations.

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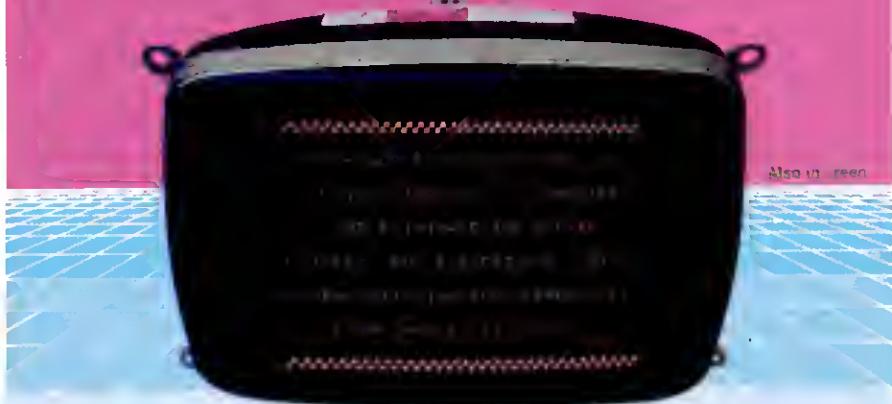
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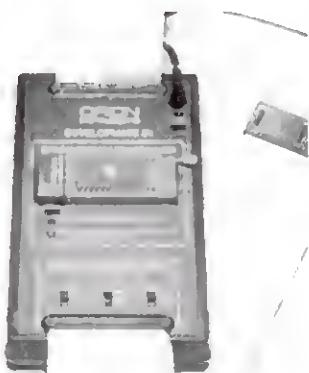
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String Commands	Description
ASC	ASCII value of a string. Example: A% = ASC(D\$)
CHR\$	Requires integer variable or integer number in parentheses. Example: B\$ = CHR\$(A%) + CHR\$(65)
Input	Don't include string expressions in quotation marks. No error-checking for string length. Example: Input A\$
Let	Optional command. Can define string variables as string expressions that include string concatenation and redefinition. No error-checking in string length occurs for concatenation and redefinition. Example: A\$ = B\$ A\$ = "First String" + CHR\$(C%) + "B\$
Print	Same as integer Print. (Table 2)
PRINT@	Same as integer Print@. (Table 2)
VAL	Compiler truncates any decimal value to an integer. Example: A% = VAL(D\$)
VARPTR	Example: A% = VARPTR(D\$)

Table 4. String functions that can be compiled. You can define many string commands with integer variables.

#### Program Listing 1. FastBas and sample Basic compilation program.

```

0 ' *** PROGRAM LINES 10-500 AND 10000-10090 ARE A SAMPLE PROGRAM
10000 READY FOR COMPILE. RUN 1000 TO COMPILE.
10 ' *** NUMERICAL ARRAY SORTING (FROM LEVELII MANUAL)
20 ' *** PASS ARRAY A FROM BASIC TO USR ***
30 N% = 0 + N%
40 FOR I% = 1 TO N%: I% = 1 * I%: A(I%) = 0 + A(I%): NEXT I%
50 ' *** SORTING PROGRAM BEGINS ***
60 D% = 1
70 D% = D% + D%: IF D% < N% THEN 70
80 D% = INT((D% - 1) / 2): IF D% = 0 THEN 140
90 T% = N% - D%: FOR I% = 1 TO T%: J% = I%
100 L% = J% + D%: IF A(L%) > A(J%) THEN 120
110 T% = A(J%): A(J%) = A(L%): A(L%) = T%: J% = J% - D%: IF J% > 0 THEN 100
120 NEXT I%: GOTO 00
130 ' *** PASS ARRAY A FROM USR TO BASIC ***
140 FOR I% = 1 TO N%: I% = 1 * I%: A(I%) = 1 * A(I%): NEXT I%
500 END
501 ***** BASIC COMPILER *****
502 *** COPYRIGHT 1981 BY D. P. BERTSEKAS, BELMONT, MASS.
503 *** PERMISSION TO USE, NOT TO SELL
505 *** ENHANCEMENTS 1984 BY T. L. QUINDRY, BURKE, VA.
506 ***
510 ***** PEEK & POKE ROUTINES *****
512 POKE M: PRINT P; : M = M + 1: IF M < -12 - MH * 16384 THEN RETURN ELSE CLS: PRINT @
320, "PROGRAM HAS EXCEEDED PROTECTED MEMORY SIZE"
513 PRINT: PRINT "LOCATION TO COMPILE LOWERED BY 512 BYTES AND PROGRAM BEING RERUN": POKE 16562, PEEK(16562) - 2: FOR N = 1 TO 2000: NEXT: GOTO 1000
514 PC = PEEK(Q): PN = PEEK(Q + 1): Q = Q + 1: IF PC = 32 THEN 514 ELSE IF PC = 0C = 2: RETURN
RNELSERETURN
510 IF PC < 65 OR PC > 90 THEN 522 ELSE RETURN
520 IF PN < > 37 THEN 522 ELSE Q = Q + 1: RETURN
522 PRINT: PRINT "ERROR LINE #"; L(L - 1): END
524 PRINT @, FS; : PRINT @, 64, CHR$(30): RETURN
529 ' ***** SINGLE PRECISION ASSIGNMENT ROUTINES *****
530 ' ROUTINE TO FIND VAR. ADDRESS PARAMETERS
535 GOSUB 514: GOSUB 510: V1 = PC - 65: IF PN < 40 AND PN > 57 AND PN < > 213 AND PN < > 40 AND PC < > 1 THEN 522
538 IF PN > 47 AND PN < 50 OR PN = 47: GOSUB 514 ELSE MI = 0
540 IF PN = 213 Z1 = 1: RETURN

```

Listing 1 continued

repeats until the program reaches a minimum HIMEM limit or until the program completely compiles.

The variable storage area is located above the compiled program and extends down from the top of memory as needed. All compiled subroutines use the same variable table area, so if you put more than one compiled program in memory, write the Dimension statement to accommodate the largest compiled subroutine.

If interference from the top of the compiled program and the allocated variable table area occurs during compilation, FastBas relocates the compiled program, corrects its jump addresses to accommodate the allocated area for variable storage, and corrects the HIMEM pointer.

Compilation can occur too low for the compiler to work. If the HIMEM pointer is too low in memory, FastBas adjusts it upwards and the program compiles at the higher memory position.

FastBas requires about 1,650 bytes above the Basic program to run. However, if FastBas relocates the HIMEM pointer to the minimum allowable value and you get an out-of-memory error, change the value + 1650 in line 1007 to a higher value.

#### Compilable Commands

Tables 1-4 list and define compilable Basic commands and explain how to use them. Table 1 lists general statements that compile. Table 2 lists the compilable integer statements. Table 3 lists compilable single-precision commands, and Table 4 contains compilable string commands.

Remember that functions that apply to integer variables give integer results, and the values that go within parentheses of the functions must be integer values or integer variables.

FastBas can't carry out arithmetic functions within parentheses when using the special integer functions, and has limited error-checking for this type of error. If FastBas finds an illegal operation, it ignores any remaining expressions on that program line.

Array locations must be integer variables. Functions that apply to single-precision variables can have single-precision variables, integer variables, or single-precision expressions within the parentheses of the function.

## Using FastBas

To compile a Basic program, number the program lines from 0-500 and continue it from line 10000 if necessary. Save the program in ASCII, then merge it with FastBas. Delete the lines relating to the sample program, then type RUN 1000 to compile the program.

As an example, try compiling Pong in Program Listing 4. This two-player paddle game demonstrates how much faster compiled code runs compared to a Basic program.

Try running the Basic version first. Use the O and L keys to move the right paddle and the Q and A keys for the left paddle. The game stops when a player gets 16 points. The highest ball speed setting moves very slowly. The compiled program runs so fast that the highest speed setting is impossible.

After you've merged your Basic program and run FastBas, it displays each Basic line number and the compilation address (except for the line containing the Dimension statement), followed by all code in decimal. A colon separates each statement in the line.

By changing the Print statements in lines 512 and 1035 of Listing 1 to LPRINT statements, you can trace where each command compiles in memory.

FastBas's last display indicates the hexadecimal (hex) and decimal values for the start, end, and transfer address of the compiled program, along with the location of the compiled program and the variable table (see the Figure).

In this last screen you have all the information needed to save and run the compiled program or subroutine. Use the start, end, and transfer hex addresses with the Dump command to save the program to disk (see your DOS manual for correct syntax).

When entering Basic, you must protect high memory or your compiled program will crash. Use the decimal notation in the second row under the column labeled Start. When in Basic, define the USR function (DEFUSR) by using the third row value under Start. This is always a negative value.

To load the compiled program into memory, type in LOAD followed by a file name from DOS Ready and hit the enter key. If you're using another DOS, use the equivalent statement. You can save the program using the CMD "L" command from Basic. Be sure to in-

```
COMPILED PROGRAM CONFLICTS WITH VARIABLE STORAGE AREA.
RELOCATING PROGRAM . . .
33 252 249 17 252 247 1 167 5 237 176 201
PROTECTED MEMORY POINTER CHANGED AND PROGRAM RELOCATED TO

HEXIDECLMAL START END TRANSFER
DECIMAL &HF7FC &HFDA3 &HF7FC
DECIMAL 63484 64931 63484
DECIMAL -2052 -605 -2052

VARIABLES STORED - &HFE3F
TO TOP OF MEMORY - &FFFFF

<ENTER> TO RUN MACHINE CODE . . .?
```

Figure. Final display after compiling the Pong program.

Listing 1 continued

```
545 IFPN=4@GOSUB514:GOSUB514:GOSUB518:V2=PC-65:GOSUB520:GOSUB514EL
SEIFCF=121=1:RETDRN
558 IFPC<>41ANDPC<>44THEN522
555 IFPC=41Z1=2:RETURN
568 IFPC=44GOSUB514:GOSUB518:V3=PC-65:IFV1<0>ORV1>=NTTHEN522ELSEGOS
UB520:Z1=3:GOSUB514:IFPC<>41OR(FN<>213ANDCF<>1)THEN522ELSERRETURN
564 ' ADDRESS COMPUTATION ROUTINE
565 ON21GOSUB570,575,580:RETURN
578 IPNI>ISTBEN522ELSEC1=VF+(V1+MI*26)*4:GOSUB036:GOSUB982:RETURN
575 V7=V1:V8=V2:GOSUB619:RETURN
580 V7=V1:V8=V2:V9=V3:GOSUB620:RETURN
688 ' ARRY PORTION OF ADDRESS ROUTINE
610 V0=V8:GOSUB912:GOSUB906:C1=VA+V7*DO*4:GOSUB836:GOSUB900:GOSUB9
04:RETURN: ' 1-D ARRAY
620 V8=V9:GOSUB912:P=41:GOSUB512:C1=VD+4*NT*OT*DT+2*V7*DT:GOSUB036
:GOSUB900:GOSUB994:P=94:GOSUB512:P=35:GOSUB512:P=06:GOSUB512:V8=V0
:GOSUB912:GOSUB986:GOSUB984:RETURN: ' 2-D ARRAY
699 ' ROUTINE TO EVALUATE SINGLE PRECISION EXPRESSIONS
700 GOSUB514:IFPC<>2@6GOTO704
702 E1=0:D1=0:GOSUB902:GOSUB926:GOSUB926:GOTO714: ' TAKES CARE OF LE
ADING <> SIGN
704 GOSUB730
706 GOSUB514:IFC=2ORPC=41ORPC=58ORPC=59ORPC=212ORPC=213ORPC=214ORP
C=141ORPC=202THENRETURN: ' PEEK NEXT BYTE, IF TERMINATOR RETURN
708 GOSUB934: ' MOVE INTERIM RESULT FRON 4121B STORAGE AREA TO STACK
710 ' MOVE NEW VARIABLE TO 4121B AREA, POP BCOE, OPERATE
712 IFPC=2@5GOSUB514:GOSUB730:GOSUB936:GOSUB8948:GOTO706: ' ADD
714 IFPC=2@6GOSUB514:GOSUB730:GOSUB936:GOSUB942:GOTO706: ' SUBTRACT
716 IFPC=2@7GOSUB514:GOSUB730:GOSUB936:GOSUB944:GOTO706: ' MULITPLY
718 IFPC=2@8GOSUB514:GOSUB730:GOSUB936:GOSUB946:GOTO706: ' DIVIDE
720 IFPC=2@9GOSUB514:GOSUB730:GOSUB936:GOSUB948:GOTO706: ' EXPONENTI
ATE
722 GOTO522: ' ERROR TRAP
729 ' ROUTINE TO EVALUATE CONSTANTS, VARIABLES & FUNCTIONS IN SING
LE PRECISION EXPRESSION & MOVE THEM TO 4121B STORAGE AREA
730 IF(FC<0@ANDPC>47)ORPC=46GOSUB045:RETURN: ' CONVERT CONSTANT TO 4
-BYTE REPRESENTATION, MOVE IT & RETURN
732 IFPC=222GOSUB514:IFPC<>4@TBN522ELSEGOSUB514:IFPC<>4@TBN522EL
SEGOSUB514:IFPC<>41THEN522ELSEP=205:GOSUB512:P=240:GOSUB512:P=28:G
OSUB512:RETURN: ' RND(0)
734 IF(PC>22@ANDPC<>229)ORPC=217ORPC=48THEN756ELSEIFPC<65ORPC>90THE
N522: ' IX FUNCTION GOTO 758
736 V4=PC-65:IFPN>47ANDPN<58THENNE=PN-47:GOSUB514:Z2=1:GOTO746ELSE
IFPN<>48ANDPN<>37THENNE=0:Z2=1:GOTO746ELSEIFPN=37THENZ2=4:GOSUB514
:GOTO746
738 GOSUB514:GOSUB514:GOSUB510:V5=PC-65:GOSUB520:GOSUB514
740 IFPC<>41ANDPC<>44THEN522
742 IFPC=41Z2=2: ' 1-D ARRAY
744 IFPC=44GOSUB514:GOSUB510:V6=PC-65:GOSUB520:Z2=3:GOSUB514:IFPC<
>41THEN522: ' 2-D ARRY
746 ON22GOTO740,750,752,754
748 IPNE>ISTBEN522ELSEC1=VF+(V4+NE*26)*4:GOSUB036:GOSUB982:GOSUB93
2:RETURN
750 V7=V4:V8=V5:GOSUB610:GOSUB932:RETDRN
752 V7=V4:V8=V5:V9=V6:GOSUB620:GOSUB932:RETURN
754 V8=V4:GOSUB912:P=34:GOSUB512:F=33:GOSUB512:P=65:GOSUB512:P=205
```

Listing 1 continued

clude the /CMD extension in the filename if you save the program this way.

Model I TRSDOS doesn't have an equivalent command to load from Basic; load from DOS instead. If you use Model III TRSDOS and the Dump command, return to DOS by rebooting instead of using CMD "S".

If the compiled program contains an INPUT\$ function and the string is more than four characters long, calling the

routine from the Basic command mode instead of from a Basic program results in a syntax error on return to Basic. However, this doesn't affect operation of the compiled program.

If you compiled Pong, the final screen should look like that in the Figure. Assuming you're using TRSDOS 1.3, you then reboot the computer and type in DUMP PONG (START = 0F7FC, END = 0FDA3, TRA = 0F7FC)

*Listing 1 continued*

```
:GOSUB512:P=204:GOSUB512:P=18:GOSUB512:RETURN: ' CONVERT INTEGER VA
R. TO SINGLE PRECISION
756 IFPC=48THEN776:'PARENTESIS
758 Q=Q+1
760 IFPC=221THEN778:'SQR
762 IFPC=217THEN780:'ABS
764 IFPC=223TBNEN782:'LOG
766 IFPC=224TBNEN784:'EXP
768 IFPC=225TBNEN786:'COS
770 IFPC=226TBNEN788:'SIN
772 IFPC=227TBNEN790:'TAN
774 IFPC=228TBNEN792:'ATH
776 GOSUB708:GOTO794
778 GOSUB708:GOSUB952:GOTO794
780 GOSUB708:GOSUB954:GOTO794
782 GOSUB708:GOSUB956:GOTO794
784 GOSUB708:GOSUB958:GOTO794
786 GOSUB708:GOSUB960:GOTO794
788 GOSUB708:GOSUB962:GOTO794
790 GOSUB708:GOSUB964:GOTO794
792 GOSUB708:GOSUB966
794 IFPC<>41THEN522
796 RETURN
888 ' ***** CONVERSION ROUTINES *****
889 ' ROUTINE TO FIND LSB & MSB OF INTEGER NUMERIC STRING
818 CS="" :IFPC=206THENPC=45:GOSUB818ELSEGOSUB816:IPC$=""THENC1=-1:RETURN
812 C1=VAL(C$)
814 D1=C1/256:E1=C1-D1*256:IFC1<8THEND1=D1+256:C1=-C1:RETURN:ELSERETURN
816 IFPC<48ORPC>57TBNENRETURN
818 CS=CS+CHR$(PC):GOSUB514:GOTO816
835 ' ROUTINES TO FIND LSB & MSB OF ADDRESSES ABOVE 1ST 32K
836 D1=C1/256:E1=C1-D1*256:D1=D1+256:RETURN
848 Z=VT+V1+V1:P1=Z/256:P=Z-P1*256:P1=P1+256:RETURN
844 ' ROUTINE TO CONVERT NUMERIC STRING TO 4-BYTE SINGLE PRECISION
REPRESENTATION
845 CS=CBRS$(PC)
846 GOSUB514:IF (PC<58ANDPC>47) ORPC=46CS=CS+CBRS$(PC):GOTO846
847 R=VAL(C$):GOSUB848:E1=33:D1=65:GOSDB902:C1=B3:GOSUB918:P=35:GOSUB512:C1=B2:GOSUB910:P=35:GOSUB512:C1=B1:GOSUB918:P=35:GOSUB512:C1=BE:GOSUB918:Q=0-1:RETURN
848 IPR=0TBNENBE=0:B1=0:B2=0:B3=0:RETURN
849 Y1=1:Y2=2:N=1:IPY1>RTHEN852
850 IFY2<=RTHENY1=Y1+Y1:Y2=Y2+Y2:N=N+1:GOTO850
851 GOTO853
852 IFR<Y1TBNENY1=Y1/2:Y2=Y2/2:N=N-1:GOTO852
853 BE=N+1:28:X1=0:R=R-Y1:GOSUB856:B1=8
854 GOSUB857:XI=X:GOSUB856:B2=B
855 GOSUB857:XI=X:GOSUB856:B3=B:RETURN
856 GOSUB857:X2=X:GOSUB857:X3=X:GOSUB857:X4=X:GOSUB857:X5=X:GOSUB857:X6=X:GOSDB857:X7=X:GOSUB857:X8=X:B=X1+X1+X2:B=B+B+X3:B=B+B+X4:B=B+B+X5:B=B+B+X6:B=B+B+X7:B=B+B+X8:RETURN
857 Y1=Y1/2:RT=R-Y1:IPRT<0X=0:RETURN:ELSEX=1:R=RT:RETURN
879 ' ROUTINE TO POKE STRING IN TEMPORARY STORAGE AREA
888 C1=NF:GOSUB836:GOSUB900:NN=1
881 IFPC=34GOSUB898:RETURN
882 GOSUB889
883 IFPP=1ANDPEEK(Q)=32Q=Q+1:PC=32:NN=NN+1:GOTO885
884 GOSUB514:NN=NN+1
885 IFPP=1AND(PC=34ORC=2) GOSUB898:RETURN
886 IFPP=0AND(PC=58ORC=2) GOSUB898:RETURN
888 GOTO882
889 P=62:GOSUB512:P=PC:GOSUB512:P=18:GOSUB512:IPPC<>8THENP=19:GOSUB512
```

*Listing 1 continued*

and hit the enter key to save the compiled program.

To load Pong, type in LOAD PONG/CMD from DOS, hit the enter key, type in BASIC - M:63484, hit the enter key, and type in DEFUSR = -2052:A = USR(0) and hit the enter key. The compiled program starts running immediately.

## Troubleshooting

FastBas checks for some syntax errors during compilation. However, other errors go undetected until you try to run the program.

If the compiled program runs but gives different results than its Basic equivalent, check arithmetic operations. The compiler and the interpreter carry out the order of arithmetic operations in a single-precision variable differently. Check also if a machine-code variable appears in the right side of an assignment statement before it's initialized.

If the compiled program crashes, check the For...Next loops; make sure they're set up properly and that the program doesn't jump out of a loop.

## Modifications

Analyzing the code in memory with a disassembler provides many clues to machine-language programming. For example, you can examine single-precision math routines and write similar code in your programs using the compiled routines as a guide.

All essential statements used in writing FastBas are in the list of compilable statements, so it's possible to rewrite the entire compiler and structure it so the program can compile itself.

However, the size of the Basic program that you must write, the number of GOTO and GOSUB statements, and the size of the resulting code might make it impractical.

Also, you'd have to change many of the variables to single-precision to have the program compile itself, so an increase in speed of more than three times is unlikely.

It's an intriguing project, however, and I'll leave that as a challenge to anyone who cares to try. ■

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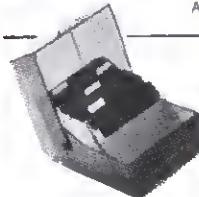
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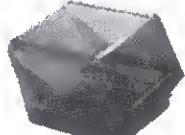
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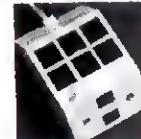
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```

1060 IFPC>64ANDPC<91ANDPN=370=Q-1:GOSUB2000: ' INTEGER LET
1065 ' SINGLE PRECISION LET
1070 IFPC>64ANDPC<91ANDPN<>37ANDPN<>360=Q-1:GOSUB535:GOSUB514:GOSU
B514,IF(PC=49ANOPN=207)OR(PC=40ANDPN=205)GOSUB4000:ELSEQ=Q-2:GOSUB
514:IFPC<>213THEN522ELSEGOSUB700:GOSUB565:GOSUB972
1075 IFPC>64ANDPC<91ANDPN=360=Q-1:GOSUB4500: ' STRING LET
1080 IFPC=170GOSUB2500: ' PRINT
1085 IFPC=141GOSUB3500: ' GOTO
1090 IFPC=143GOSUB3000: ' IF ... THEN
1095 IFPC=145GOSUB3700: ' GOSUB
1100 IFPC=146GOSUB3000: ' RETURN
1105 IFPC=132THENP=205:GOSUB512:P=201:GOSUB512:P=1:GOSUB512:GOSUB5
14:IFPC<>50ANDC<>2THEN522: ' CLS
1110 IFPC=137GOSUB2700: ' INPUT
1115 IFPC=129GOSUB5000: ' FOR
1120 IFPC=135GOSUB5500: ' NEXT
1125 IFPC=130ORPC=131GOSUB6000: ' SET & RESET
1127 IFPC=177GOSUB6500: ' POKE
1130 IFPC=120P=205:GOSUB512:P=157:GOSUB512:P=10:GOSUB512:P=201:GOS
UB512: ' END
1135 IFPEEK(Q-1)=580RPEEK(Q-1)=149PRINTT$:GOTO1045: ' TEST FOR TER
MINATOR & ELSE TOKEN
1140 0=M1PRINT:GOTO1025: ' START NEW LINE
1200 ' ***** ROUTINE TO ADJUST THE MACHINE CODE JUHPS *****
1210 GOSUB524:IFK=0THEN1250ELSEPRINT#960,"ADJUSTING JUMP ADDRESSES
".
1220 FORI=1TOK:DN=PEEK(A(I))+256*PEEK(A(I)+1):DH=0
1230 FORJ=1TOL:IFDN=L1(J)THENDH=L2(J):PRINTL1(J);
1240 NEXTJ:CL=OH:GOSUB036:POKEA(I),E1:POKEA(I)+1,D1:NEXTI
1250 CLS:IFVN=3>MTHEN1310ELSESTR=M-VN+3:MO=TR/256:IFTR>MO*256THENM
O=MO+1
1260 PRINT:PRINT"COMPILED PROGRAM CONFLICTS WITH VARIABLE STORAGE
AREA."
1280 IFMC-MO*256>FMTHENGOTO1286ELSEPRINT:PRINT"TO RECOMPILE PROGRA
M IN LOWER MEMORY WOULD OVERWRITE YOUR":PRINT"BASIC PROGRAM. TRY T
O REDUCE THE VARIABLE STORAGE AREA BY":PRINT"REDIMENSIONING VARIAB
LES. PROTECTED MEMORY HAS BEEN MOVED TO"
1285 PRINT"THE MINIMUM VALUE TO ALLOW THE BASIC COMPILER TO RUN.":C1=FM-3:GOSUB014:POKE16561,E1:POKE16562,D1:END
1286 PRINT"RELOCATING PROGRAM . . .":M2=M:P=33:GOSUB512:C1=MC:GOSU
B014:P=EL:GOSUB512:P=D1:GOSUB512:P=17:GOSUB512:P=EL:GOSUB512:P=D1-
MO:GOSUB512:P=1:GOSUB512:CL=M2-MC:GOSUB014:P=EL:GOSUB512:P=D1:GOSU
B512
1287 P=237:GOSUB512:P=176:GOSUB512:P=201:GOSUB512:DEFUSR1=M2:MC=MC
-MO*256:M=M-MO*256-12
1288 IFK1=0THENFORI=1TOK1:POKEA1(I),PEEK(A1(I))-MO:NEXTI
1289 IFK1>0THENFORI=1TOK:POKEA(I)+1,PEEK(A(I)+1)-MO:NEXTI
1290 PRINT:PRINT"PROTECTED MEMORY POINTER CHANGED AND PROGRAM RELO
CATED TO":GOTO1310
1299 ' ***** ROUTINE TO EXECUTE THE MACHINE CODE DIRECTLY *****
*
1300 GOSUB814:E2=EL/16:02=D1/16:EL=EL-E2*16:D1=D1-D2*16:IFD2>9TBEN
D2=D2+55ELSED2=D2+48
1301 IFD1>9THEND1=D1+55ELSED1=D1+48
1302 IFE2>9THENE2=E2+55ELSEE2=E2+48
1303 IFE1>9THENE1=E1+55ELSEE1=E1+48
1304 B$="&H"+CHR$(D2)+CHR$(D1)+CHR$(E2)+CHR$(E1):PRINTB$:,RETURN'C
ONVERSION TO HEX
1310 DEFUSR0=MC:PRINT#304,,,"START",,"END",,"TRANSFER":PRINT"HEXIDEI
MAL":,C1=MC:GOSUB1300:C1=M:GOSUB1300:C1=MC:GOSUB1300:PRINT"DECIMAL
"TAB(15)65536+MCTAB(31)65536+MTAB(47)65536+MC:PRINT"DECIMAL",MC,M,
MC:PRINT
1315 PRINT"VARIABLES STORED - ";C1=VN-3:GOSUB1300:PRINT:PRINT"TO
TOP OF MEMORY - ";C1=-MR*16384-1:GOSUB1300:PRINT
1316 IFTR>0THENPOKE16562,PEEK(16562)-MO:CLEAR50:X=USR1(0)
1320 PRINT#960,<ENTER> TO RUN MACHINE CODE . . .";
1330 INPUTA$
1340 CLS:X=USR(0):END
1400 ' ***** END OF MAIN PROGRAM *****
1999 ' INTEGER ASSIGNMENT ROUTINE
2000 GOSUB514:GOSUB510:GOSUB520:V1=PC-65:GOSUB514:IFPC<>213TREN522
2010 GOSUB514:IF(PC=49ANDP=207)OR(PC=40ANDPN=205)THEN2400
2011 IFPC=246THENGOSUB2017:P=126:GOSUB512:GOTO2027: ' ASC
2012 IFPC<>192THEN2015ELSEGOSUB2017:V1=V3:C1=VN-2:GOSUB014:P=34:GO
SUB512:P=EL:GOSUB512:P=D1:GOSUB512:P=6:GOSUB512:P=255:GOSUB512:P=1
26:GOSUB512:P=4:GOSUB512:P=35:GOSUB512:P=103:GOSUB512:P=32:GOSUB51
2:P=250:GOSUB512:P=120:GOSUB512
2013 C1=VN-3:GOSUB814:GOSUB902:P=119:GOSUB512:GOSUB916:GOSUB514:RE
TURN' VARPTR OF STRING
2015 IFPC<>245THEN2026ELSEGOSUB2017:P=126:GOSUB512:P=254:GOSUB512:
P=45:GOSUB512:P=32:GOSUB512:P=2:GOSUB512:P=55:GOSUB512:P=35:GOSUB5
12:P=245:GOSUB512
2016 P=205:GOSUB512:P=90:GOSUB512:P=30:GOSUB512:P=241:GOSUB512:P=4
8:GOSUB512:P=7:GOSUB512:P=33:GOSUB512:P=0:GOSUB512:GOSUB512:P=103:
GOSUB512:P=237:GOSUB512:P=02:GOSUB512:GOSUB900:GOSUB900:V1=V3:GOSU
B916:GOSUB514:RETURN' VAL
2017 V3=V1:Q=Q+1:GOSUB514:GOSUB510:IPPN<>36THEN522:ELSEQ=Q+1:V1=PC

```

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```

2678 P=6:GOSUB512:P=P1:GOSUB512:P=285:GOSUB512:P=58:GOSUB512:P=3:
GOSUB512:RETURN; ' SCREEN CONTROL ROUTINE
2688 GOSUB336:GOSUB9@:GOSUB9@:GOSUB514:IFPC=34GOSUB514:RETURNELS
2699   INPUT
2700   INPUT
2700 P=285:GOSUB512:P=179:GOSUB512:P=27:GOSUB512:IFPC=36T
BENGOSUB51@:GOSUB9@:Q=Q-1:V1=PC-65:NP=VS+VI*(SL+)-1:C1=M:GOSUB@:
14:GOSUB9@:GOSUB512:GOTO47@:ELSE@=35:GOSUB512:P=108GOSUB51
21P=14:GOSUB512
2710 IPN=37P=285:GOSUB512:P=10:GOSUB512:V1=PC-65:G
OSUB84@:E1=P1:D1=P1:GOSUB9@:P=237:GOSUB512:P=75:GOSUB512:P=33:GOSU
B512:P=65:GOSUB512:P=35:GOSUB512:P=112:GOSUB512:GOS
UB514:GOSUB514:IFPC=>22THEN52ELSE@=20:GOSUB512:P=112:GOSUB512:GOS
UB512:Q=Q-1:CP=1:GOSUB535:CP@:P=5:GOSUB512:P=175:GOSUB512:P=64:GO
SUB512:P=222:GOSUB512:P=4:GOSUB9@:P=205:GOSUB512:P=284:G
QSUB512:P=10:GOSUB565:GOSUB972:GOSDB514:IFPC=>5BANDC<>2TH
EN522ELSE@:RETURN
2799   INTEGER IP - THEN ROUTINE
3000   GOSUB514:IFPH=>37THEN31@ELSEGOSUB528:V1=PC-65:GOSUB
90@:GOSUB514
3005 IFPC=212ANDPN=213ORPC=213ANDPN=212W@:1:0=0+1:GOTO3@35
3010 IFPC=214ANDPN=213ORPC=213ANDPN=214W@:2:0=0+1:GOTO3@35
3015 IFPC=212ANDPN=214ORPC=214ANDPN=212W@:3:0=0+1:GOTO3@35
3020 IFPC=212W@:4
3025 IFPC=214W@:5
3030 IFPC=213W@:6
3035 GOSUB514:IFPC=<5BORPC=206GOSUB81@:GOSUB9@2ELSEGOSUB51@GOSUB52
@:V1=PC-65:GOSUB514
3040 IFPC=>202ANDPC=>141THEN522ELSEGOSDB514:IFPC=141GOSUB514
3045 GOSUB81@:IFC1=<B0RCL>5@THEN32
3050 P=205:GOSUB512:P=57:GOSUB512:P=18:GOSUB512
3055 GOTO315@
3059 GOTO315@
3063 SINGLE PRECISION IP - THEN ROUTINE
3100 Q=1:GOSUB7@:GOSUB93@
3105 IFPC=212ANDDPH=213ORPC=213ANDPN=212W@:1:0=0+1:GOTO3@35
3110 IFPC=214ANDDPH=213ORPC=214ANDPN=214W@:2:0=0+1:GOTO3@35
3115 IFPC=212ANDDPH=214ORPC=214ANDPN=212W@:3:0=0+1:GOTO3@35
3120 IFPC=212W@:4
3125 IFPC=214W@:5
3130 IFPC=213W@:6
3135 GOSUB7@:GOSUB93@:GOSUB95@
3140 IFPC=>202ANDPC=>141THEN522ELSEGOSUB514:IFPC=141GOSUB514
3145 GOSUB81@:IFC1=<B0RCL>5@THEN522
3150 D@1:E@51:QW1GOTO3155,316@,3165,317@,3175,318@
3155 GOSUB3185:GOSUB328@:RETURN
3160 GOSUB3185:GOSUB319@:RETURN
3165 GOSUB319@:RETURN
3170 P=4@:GOSUB512:P=3:GOSUB512:GOSDB32@:RETURN
3175 P=4@:GOSUB512:P=3:GOSUB512:GOSUB319@:RETURN
3180 GOSUB3185:RETURN
3185 P=202:GOSUB33@:RETURN
3190 P=242:GOSUB33@:RETURN
3195 P=194:GOSUB33@:RETURN
3200 P=250:GOSUB33@:RETURN
3205 P=195:GOSUB33@:RETURN
3300 GOSUB512@:K@=K+1:A@=M:P=E:GOSUB512:P=0:GOSUB512:RETURN
3310 K1-K1+1:A@K1@=R:RETURN
3499   GOTO ROUTINE
3500 GOSUB514:GOSUB81@:IFC1=<B0RCL>5@THEN522ELSE@=1:E=E1:GOSUB32@:
5:RETURN
3699   GOSUB ROUTINE
3700 GOSUB514:GOSUB81@:IFC1=<B0RCL>5@THEN522ELSE@=0:1:E=E1:P=205:GO
GOTO522

```

```

5999 ! POINT, SET & RESET
6000 IFPC=130TBENW=1ELSEIFPC=131TBENW=120ELSEIFPC=198TBENW=0
6010 MA=N
6020 GOSUB514:IFPC<>40TBEN522ELSEGOSUB514:GOSUB010:IFCL=1:GOSUB510
1:GOSUB520:V1=PC-65:GOSUB040:D2=P1:E2=P:C2=1ELSEE2=1:C2=0:IFPC<>44
TBEN522
6030 IFPC2=1GOSUB514:IFPC<>44TBEN522
6040 GOSUB819:GOSUB510:IFCL=1:GOSUB520:V1=PC-65:GOSUB819:
D3:P1:E3=P:C3=1ELSEE3:EL1:C3=0:IFPC<>41TBEN522
6050 IFPC3=1GOSUB514:IFPC<>41TBEN522
6060 GOSUB514:IFPC<>8ANDC<>2TBEN522
6070 C=HA1:8+C3:GOSUB836:GOSUB920:W=1:GOSUB833:W=1:GOSUB839
26:EL1=126:D1=7:1:GOSUB892:W=62:GOSUB512:P=25:GOSUB512
6080 IFPC2=1TBEN522:IFPC=P=50:GOSUB512:P=E2:GOSUB512:P=D2:GOSUB512:ELSEP=62:
GOSUB512:P=52:GOSUB512
6090 P=245:GOSUB512
6100 IFPC3=1TBENP=50:GOSUB512:P=E3:GOSUB512:P=U1:GOSUB512ELSEP=62:G
OSUB512:P=E:GOSUB512
6110 EL1=80:D1=1:GOSUB819:RETURN
6120 ! ROUTINE
6130 GOSUB514:GOSUB010:IFCL=1TBENGOSUB8510:GOSUB520:V1=PC-65:GOSUB
914:GOSUB514ELSEGOSUB920
6150 IFPC<>44TBEN522
6160 GOSUB514:GOSUB819:IFPC<>1GOSUB520:V1=PC-65:GOSUB840:
EL1=P:D1=P1:P=5:8:GOSUB512:P=U1:GOSUB512:P=D1:GOSUB512:GOSUB514ELSEP
=62:GOSUB512:P=U1:GOSUB512
6170 IFPC<>5ANDC<>2TBEN522
6180 GOSUB514ELSEGOSUB512
6190 P=119:GOSUB512:RETURN
6199 ! ROUTINE FOR CODE TO STORE 2-0 ARRAY ADDRESSES : PRINT:C1=VD
7000 GOSUB524:PRINT"CODE TO STORE 2-D ARRAY ADDRESSES":PRINT:C1=VD
7001 :GOSUB036:GOSUB902
7010 C1=VD+4*NT*DT*DT:GOSUB636:P=221:GOSUB902:C1=4*OT:GOS
UB814:GOSUB900
7020 C1=NT*OT:GOSUB814:P=1:GOSUB512:P=U1:GOSUB512
7030 P=221:GOSUB512:P=U1:GOSUB512
7040 P=221:GOSUB512:P=35:GOSUB512
7050 P=221:GOSUB512:P=116:GOSUB512:P=13:GOSUB904:P=13:GOSUB512
7060 P=221:GOSUB512:P=35:GOSUB512:RETURN
7070 C1=M-12:GOSUB836:P=194:GOSUB512:P=U1:GOSUB512:P=12:P=U1:GOSUB3310:
GOSUB512
7080 P=5:GOSUB512:P=14:GOSUB512:P=255:GOSUB512:C1=M-10:GOSUB
836:P-
7090 PRINT#856,"MAIN CODE BEGINS":RETURN
7100 GOSUB514:Q1=Q:IFPC=50THEN710ELSEIFPC<>2THENGOT07100:CLEAR
7110 GOSUB514:RETURN
7120 Q=0+4
7130 GOSUB514:RETURN
7140 GOSUB514:RETURN
7150 IS=1:DO:0:DT=0:ND=0:NT=0:NS=2:DIM
7160 GOSUB514:Q1=Q:IFPC=58THENQ=Q-4:Q1=Q:RETURN ELSEIFPC=2TBEN
RETURN ELSEIFPC=44THEN7112
7170 GOSUB514:IFPC<>40TBEN07112
7180 GOSUB514:IFPC<>44TBEN07112
7190 GOSUB514:IFPC<>44TBEN7130ELSEIFPC=44THEN07130ELSEIFPC=44TBEN
7112 CS="" :GOSUB514:Q1=Q:IFPC=58THENQ=Q-4:Q1=Q:RETURN ELSEIFPC=2TBEN
RETURN ELSEIFPC=44THEN7112
7112 GOSUB514:IFPC<>650RPC>98TBEN7124ELSEIFPC=65ANDPC>98TBEN7124ELSEIFPC=65
S=CS+CBRS(PC):GOT07122
7124 NT=V3:IFDT=VAL(CS):THENGOT07112
7126 PRINT"ERROR IN DIM STATEMENT":END
7130 IFV=1TBENNO=V3:DO=VAL(CS)
7132 IFV=2TBENHS=V3:BL=VAL(CS)
7134 GOT07112
7135 GOSUB514:IFPC<>50ANDC<>2TBEN7135

5999 ! POINT, SET & RESET
3799 ! RETURN
3999 ! SINGLE PRECISION VARIABLE TRANSFER ROUTINE
4000 IFPC=49ANDPN=207TBENCH=1ELSECM=0
4010 GOSUB514:GOSUB514:IFPC<>213TBEN522
4020 IFPC=13:GOSUB512:P=30:GOSUB512
4030 GOSUB930:GOSUB565:GOSUB932:GOSUB924:GOSUB972:RETURN
4040 GOSUB514:V1=PC-65:MF*V1*(SL+1)
4050 STRING ASSIGNMENT ROUTINE
4060 GOSUB514:IFPC<>367TBEN522
4070 GOSUB514:IFPC=243TBEN522
4080 GOSUB514:IFPC=247TBEN460ELSEIFPC>64ANDPC<91:THEN4700ELSEIFPC<
>34TBEN522
4090 PC=PEEK(Q):Q=U+1:FP=1:GOSUB800:FP=0
4100 GOSUB514:IFPC=34GOSUB514
4110 IFPC=205ANDPN=245TBENGOSUB980:GOTO4710
4120 IFPC=205ANDPN=34TBENPC>PEEK(Q+1):Q=Q+2:FP=1:NN=1:GOSUB001:PP=
9:GOTO4550ELSEIFPC=205TBENGOSUB514:IFPC>4ANDPC<1ANDP8=6:THENQ=Q+
1:GOSUB909:P=43:GOSUB512:GOTO4705ELSE522
4130 RETURN
4140 C1=MF:GOSUB836:GOSUB902
4150 GOSUB514:IFPC<>40TBEN522ELSEFCS="""
4160 GOSUB514:IFPC>64ANDPC<91TBENV1=PC-65:GOSUB530:GOSUB514:IFPC<
>41TBEN522ELSEFCS="""
4170 GOSUB514:IFPC>64ANDPC<91TBEN840:GOSUB512:P=P1:GOSUB512:P=119:G
OSUB512:GOT04668
4180 IP (PC<>480RPC>57)ANDPC<>41TBEN522
4190 IFPC<>41TBENCS=C$+CBRS(PC):GOSUB514:GOTO4620
4200 C1=VAL(CS)
4210 GOSUB910
4220 GOSUB514:IFPC=205GOSUB514:IFPC<>247TBENP=35:GOSUB512:Q=Q-2:GO
SUB514:GOT0470ELSEP=5:GOSUB512:GOT04610
4230 IFPC=580RC=2TBENP=35:GOSUB512:C1=0:GOSUB910:RETURN ELSESEGOT0522
4240 STRING ASSIGNMENT USING PREVIOUSLY DEFINED VARIABLE
4250 IFPN<>36TBEN522ELSEQ=Q+1:C1=MF-1:GOSUB814:GOSDB902
4260 V1=PC-65:MX=VS+V1*(SL+1)-1:C1:MX:GOSUB836:GOSUB908
4270 P=35:GOSUB512:P=19:GOSUB512:P=26:GOSUB512:P=119:GOSUB8512:P=18
3:GOSUB512:P=12:GOSUB512:P=24:GOSUB512:GOSUB514
4280 IFPC=205ANDPN=247TBEN0=Q-1:P=43:GOSUB512:GOT04660
4290 GOSUB514:IFPC=205ANDPN=34TBENGOSUB80:GOT0457ELSEIFPC=205TBENGOSUB514
:GOSUB514:IFPC>367TBEN522ELSEQ=Q+1:P=43:GOSUB512:GOT04705
4300 RETURN
5000 C1=M+7:GOSUB036:GOSUB514:GOSUB510:GOSUB520:V1=PC-65:GOSUB840:
GOSUB514:D(V1)=D1:E(V1)=E1:IFPC>213TBEN522
5010 GOSUB514:IFPC<650RPC=205GOSUB818:J1=0:ID=D1:FE=EL1:Q=Q+1
5020 IFPC<>199TBEN522
5030 GOSUB514:IFPC<650RPC=205GOSUB8010:J2=0:FD=D1:FE=EL1:Q=Q+1
5040 IFJ2=0:TBENP=33ELSEP=42
5050 GOSUB512:P=FE:GOSUB512:FD=D1:FE=EL1:Q=Q+1
5060 IFJ1=0:THEN1=1:E:D1=ID:GOSUB902
5070 IFJ1=1:TBENP=42:GOSUB512:P=FE:GOSUB512:P=ID:GOSUB512
5080 GOSUB916:IFPEEK(Q-1)<>50ANDPEEK(Q-1)<>0TBEN522ELSERETURN
5090 GOSUB926:GOSUB920:GOSUB510:GOSUB924:GOSUB512:P=E(V1):
GOSUB512:P=D(V1):GOSUB8310:GOSUB924:GOSUB514:RETURN

```

```

110 BA=INT(B):PRINT"STRING LOCATION IS "1B
120 'THE NEXT LINE WILL NOT GIVE THE SAME RESULTS IN BASIC
130 BA=BA+5:POKEBA,0
140 PRINT"THE ORIGINAL STRING IS "1A$"
150 PRINT"THE EQUIVALENT OF BS=LEFT$(AS,5) IS . . . "1B$"
500 END

```

End

```

7136 CL=VN:GOSUB814:P=175:GOSUB512:GOSUB902:P=119:GOSUB512:CL=VN+1
:GOSUB814:GOBUG900:CL=-MR*163B4-VN-1:GOSUB814:P=1:GOSUB512:P=E1:GO
SUB512:P=D1:GOSUB512:P=237:GOSUB512:P=176:GOSUB512:RETURN'CLEAR
500 **** END OF THE COMPUTER ****
16910 DIM A(400):INPUT"ARRAY DIMENSION",R$*
16911 FOR I$=1 TO N$=A(1$)-200*RND(6):NEXT I$*
16912 FOR I$=1 TO N$=1:PRINT A(I$):NEXT I$:PRINT
16949 PRINT "PRESS A KEY TO RUN"
16950 A$=INKEY$:IF A$="" THEN 10050
16868 X=USR(8)
16870 PRINT "DONE":PRINT:PRINT "PRESB A KEY TO PRINT THE SON
TED ARRAY"
16955 A$=INKEY$:IF I$=1 TO N$:PRINT A(I$):NEXT I$*
10890 FOR I$=1 TO N$:PRINT A(I$):NEXT I$*

```

End

*Program Listing 2. Demonstration program using string Input, ASC, Clear, and Dimension statements.*

```

10 CLEAR50:DIMAS(40):A1
20 CLS
30 PRINT:PRINT"Answer Yes, No, or Quit":INPUTAS:A$=ASC(A$)
40 'THE ASCII VALUE FOR Q IS 81. Q IS 113
50 IFA=81THEN12ELSEIIPA=113THEN120
60 'THE ASCII VALUE FOR N IS 78, N IS 110
70 IFA=78THEN11ELSEIIPA=110THEN100
80 'THE ASCII VALUE FOR Y IS 89, Y IS 121
90 IFA=89THEN110ELSEIIPA=121THEN119ELSEGOTO30
100 PRINT"THE answer was no.":GOTO30
110 PRINT"THE answer was Yes.":GOTO30
120 PRINT:PRINT"You asked to quit."
130 PRINT"YOU are now returned to BASIC."
500 END

```

End

*Program Listing 3. Using substitute programming techniques for compilation purposes.*

```

10 CLEAR50:DINBS(68)
20 CLS
30 PRINT"EXAMPLES OF VARPTR(AS), LEN(AS), AND LEFT$(AS,5)"*
40 PRINT"USING SUBSTITUTE PROGRAM FOR COMPILATION PURPOSES":PRINT
58 PRINT"ENTER A TEN CHARACTER STRING":INPUTAS
68 BS=A$=VARPTR(B$):PRINT"VARPTR LOCATION IS "1A$:PEEK(A$)
78 IFB$<-10THEN80ELSEPRINT"STRING IS GREATER THAN TEN CHARACTERS":GOTO50
88 IFB$=10THEN90ELSEPRINT"STRING IS LESS THAN TEN CHARACTERS":GOTO
98 B$=A$+1:BA=PEEK(8$):C$=A$+2:C$=PEEK(C$)
100 B$=C$*256+B$:IFB$<32768THEN110ELSEB$=B-65536

```

End

*Program Listing 4. Basic Pong game.*

```

5 DIMAS(40):A1
10 QA=20:IA=25
15 LB=25:OB=20
20 CLS:PRINT"bow fast (1 to 1000)?":INPUT DA:CLS:NA=0:SA=0:PRINT
8132,NA:PRINT#186,5%
25 FORY=9TO39:SET(8,Y$):SET(127,Y$):NEXTY
30 CA=1
35 PRINT#158,"Pong" :
40 KA=1
45 FORI=1-9TO25:SET(7,I$):SET(126,I$):NEXTI
50 FORX=1TO126:SET(X$,9):SET(X$,39):NEXTX%
55 Y$=19724-INT(168*RND(B$)):KA=KA+10
60 SET(X$,Y$)
65 FORI=1-TOO:NEXTI
70 RESET(X$,Y$)
75 VA=PEEK(14337):CA=PEEK(14340):WA=PEEK(14340):Z$=VA+WA+WA
80 IFZ$<16THEN105
85 IFA1>16THEN95:ELSEGOSUB205
90 IFA1>16THEN95:ELSEGOSUB210
95 IFA1>2THEN100:ELSEGOSUB215
100 IFA1>2THEN105:ELSEGOSUB220
105 Z$=PEEK(14400):IFZ$=4THEN500
110 X$=X$+C$:
115 Y$=Y$+E$:
120 IFY$>39THEN125ELSEIFY$>9THEN140
125 IX$=122THEN185
130 IFOX$>16THEN160
135 BA=POINT(X$,Y$):IFBA<@THEN160
140 IX$=122THEN185
145 IFOX$>5THEN180
150 BA=POINT(X$,Y$):IFBA<@THEN170
155 GOTO60
160 KA=FA
165 GOTO115
170 CA=CA
175 GOTO110
180 ST=ST+1:PRINT#1106,SA!IFSA>15THEN190:ELSEGOTO55
185 NA=NA+1:PRINT#112,NA$:IFNA>15THEN190:ELSEGOTO55
190 PRINT#982,"Play Again? (Y/N)":"
195 Z$=PEEK(14344):IFZ$=64THEN210
200 Z$=PEEK(14333):IFZ$=64THEN500ELSEGOTO195
205 RESET(120,L$):OB=0$-1:L$=L$-1:SET(120,OB):RETURN
210 RESET(120,OB):OB=0$+1:L$=L$+1:SET(120,L$):RETURN
215 RESET(7,AA):QA=QA-1:AA=AA-1:SET(7,QA):RETURN
220 RESET(7,QA):QA=QA+1:AA=AA+1:SET(7,AA):RETURN
500 END

```

End

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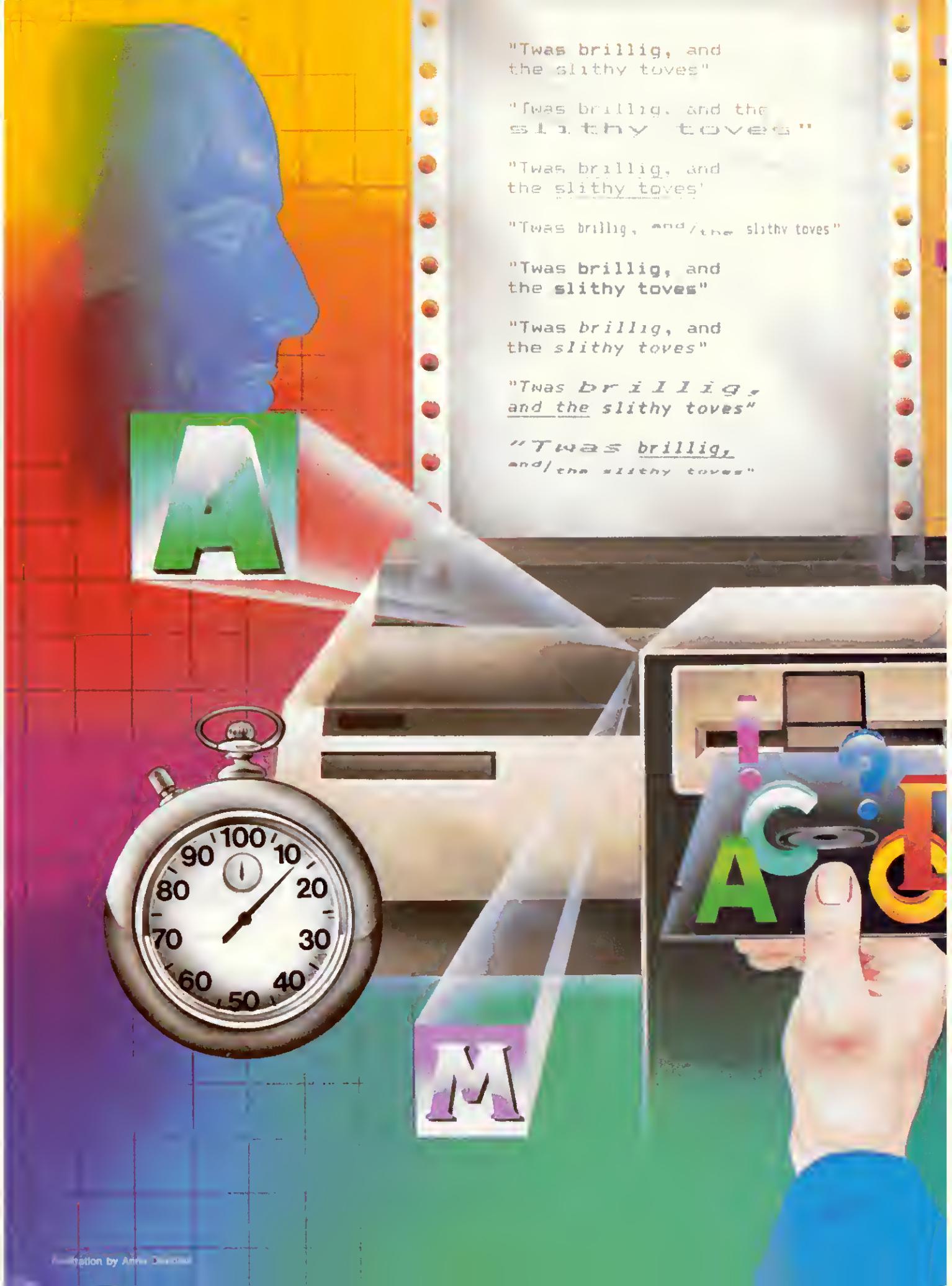
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"Twas brillig, and  
the slithy toves"

"Twas brillig, and the  
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"Twas brillig, and  
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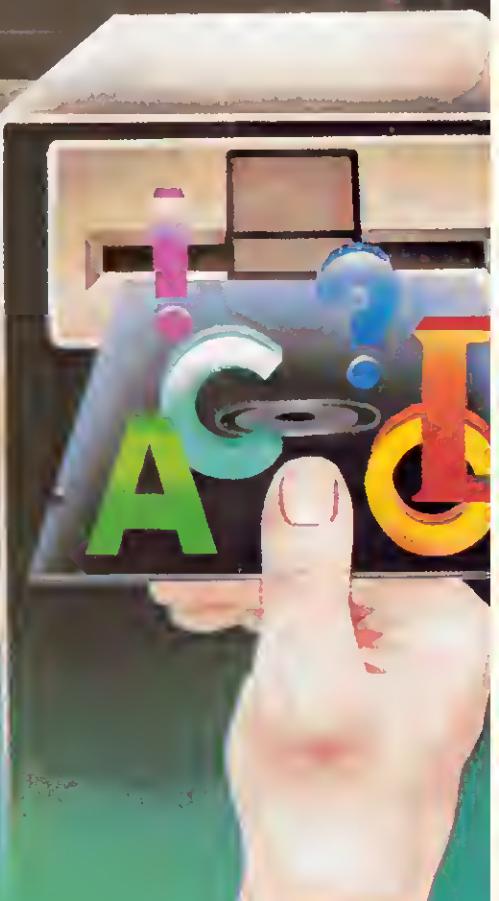
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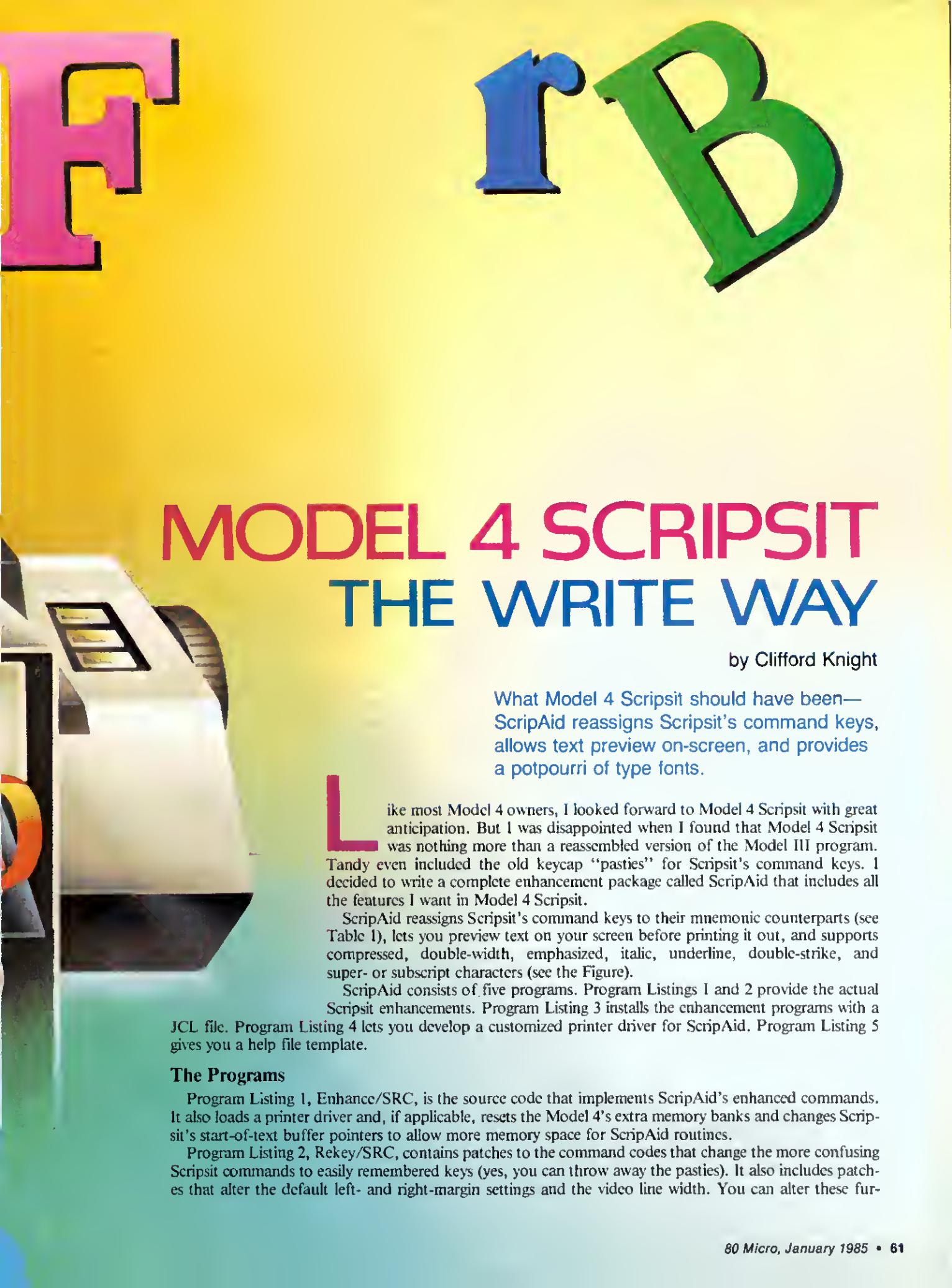
"Twas brillig, and  
the slithy toves"

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and the slithy toves"

"Twas brillig,  
and the slithy toves"





# MODEL 4 SCRIPSIT THE WRITE WAY

by Clifford Knight

What Model 4 Scripsit should have been—  
ScripAid reassigns Scripsit's command keys,  
allows text preview on-screen, and provides  
a potpourri of type fonts.

Like most Model 4 owners, I looked forward to Model 4 Scripsit with great anticipation. But I was disappointed when I found that Model 4 Scripsit was nothing more than a reassembled version of the Model III program. Tandy even included the old keycap "pasties" for Scripsit's command keys. I decided to write a complete enhancement package called ScripAid that includes all the features I want in Model 4 Scripsit.

ScripAid reassigns Scripsit's command keys to their mnemonic counterparts (see Table 1), lets you preview text on your screen before printing it out, and supports compressed, double-width, emphasized, italic, underline, double-strike, and super- or subscript characters (see the Figure).

ScripAid consists of five programs. Program Listings 1 and 2 provide the actual Scripsit enhancements. Program Listing 3 installs the enhancement programs with a JCL file. Program Listing 4 lets you develop a customized printer driver for ScripAid. Program Listing 5 gives you a help file template.

## The Programs

Program Listing 1, Enhance/SRC, is the source code that implements ScripAid's enhanced commands. It also loads a printer driver and, if applicable, resets the Model 4's extra memory banks and changes Scripsit's start-of-text buffer pointers to allow more memory space for ScripAid routines.

Program Listing 2, Rekey/SRC, contains patches to the command codes that change the more confusing Scripsit commands to easily remembered keys (yes, you can throw away the pasties). It also includes patches that alter the default left- and right-margin settings and the video line width. You can alter these fur-

```

>TM=5
>C=Y
\3*** ScripAid \4printer control demonstration\$ ***
>C=N
\#
This is an example of the power of \6\3ScripAid\#\&.

\3You can set the emphasized mode at the start of your text, and then add \6DOUB
LE-STRIKE\& for added visual impact.

\#You can switch to \2DOUBLE-WIDTH\& and back.

Or underline \5here\% and \5there\% as you wish.

Even \1compressed\! and \1super\&/\7sub\& scripts may be used.

\3Y\#\20\\"3\6U\&\# can \4do it all\$ \3 with \6\5ScripAid\%\&.

```

\*\*\* ScripAid printer control demonstration \*\*\*

This is an example of the power of ScripAid.

You can set the emphasized mode at the start of your text, and then add DOUBLE-STRIKE for added visual impact.

You can switch to DOUBLE-F--WIDTH and back.

Or underline here and there as you wish.

Even compressed and super/sub scripts may be used.

YUO can do it all with ScripAid.

Figure. Text with ScripAid commands embedded (top) and as it appears when you print it out (bottom).

ther if you want to boot up the program with other values set. In addition, I modified all prompts and error messages to provide upper- and lowercase characters.

Program Listing 3, the JCL file, installs the Scripsit overlays assembled from the source code so you can use ScripAid.

Program Listing 4, Driver/BAS, lets you customize a printer driver file. It prompts you to assign printer control codes for each ScripAid print command. For instance, \1 is the ScripAid command that prints a compressed character. When Driver prompts you to input the code that makes your printer print a compressed character, you should find the right code in your print-

er manual and type it in.

Every printer requires a different driver as there are no standard printer control codes. Table 2 (p. 65) shows the codes I used with my Epson MX-80 printer. Table 3 (p. 65) defines the print commands you embed in your text.

Program Listing 5, Helper, gives you the information you need to develop a help file.

### Creating ScripAid

Type in and assemble Program Listings 1 and 2, and save them as Enhance/OVL and Rekey/OVL.

Now you're ready to build the JCL file in Program Listing 3. Use the DOS Build command or Scripsit (saved in ASCII format) and write it to the same disk that contains the overlay files. (I recommend that you use a system disk in drive 1 as the target for all the ScripAid files. This way, you'll end up with the entire ScripAid program on a single disk.)

If you're a single-drive user, write all files to drive zero, then delete all references to drive 1 from the JCL file.

To create ScripAid/CMD, first insert a back-up copy (for added security) of the original Scripsit program in drive zero. The system disk containing both the

ScripAid overlay files and the JCL file should be in drive 1. Now type in DO SCRIPAIID:1. This executes the DOS commands of the JCL file, transforming your version of Scripsit to the upgraded ScripAid. Single-drive users should copy their Scripsit to a system disk and assemble the two overlay files on the same disk. Then execute the modified JCL (mentioned above) and you're ready to use ScripAid.

Although you don't have to use ScripAid's new print codes, you do have to include at least one printer driver so the program can load and execute. You should name this driver Default/PDC and put it on the same disk as ScripAid. If you have access to more than one printer, you can develop driver files for each printer. When calling ScripAid, specify the driver you want on the TRSDOS command line by typing in SCRIPAIID followed by the driver file name.

You can create a driver file for your printer with the help of Program Listing 4. Here, the first screen prompts you to enter either a file name for the file you want to create, or hit control-Q to quit. If you hit the enter key, the program uses the file name Default.

Once you specify the file name,

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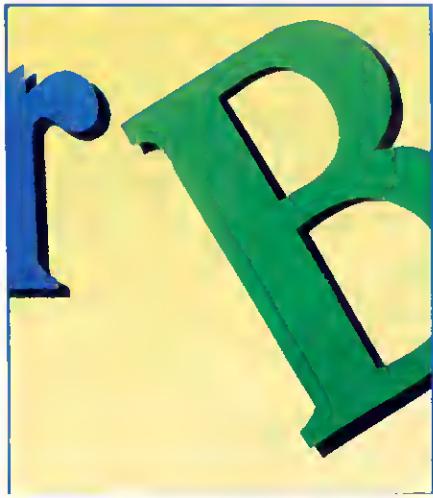
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ScripAid creates two files, one with the extension /PDC for the driver, and one with the extension /HLP for the driver help screen. The next screen displays the file name used, the current code assignments, and the shifted complements for keys 1-9. A prompt at the bottom of the screen gives you the following options: to enter the key you want programmed, to save the current assignments (S), or to abort and cancel all changes (A).

If you hit any of the control-code keys, you'll be prompted to enter up to five decimal numbers that, in turn, form the format control string assigned to the previously selected key. After entering the five values you'll see that they've been assigned to the selected key. If your printer's control sequence doesn't require 5 bytes (values) then hit the enter key in response to the next CODE # prompt to terminate data entry.

Then ScripAid asks you to enter a short description (up to 70 characters) of this control string's function. The program displays this information when you request printer help from ScripAid. When you've finished programming, type in S to save the files. ScripAid then returns you to the first menu from which you can opt to create another driver or quit ScripAid.

If you want to include a help file with ScripAid, Program Listing 5 will help you build your own. Such a file, however, takes up more than 20K of disk space, which is why I find a quick-reference card more convenient.

## The Source Code

Program Listing 1, ScripAid's source code, is fully commented, but it's important that you understand the main logic flow. First, the program defines the supervisor calls (SVCs) and then assigns the hook vectors to and from Scripsit. Lines 880-1150 alter the sign-

## Reassigned Scripsit Commands

### General Commands

Clear-B	Enter text block
Clear-I	Insert text
Clear-G	Start paragraph
Clear-L	End line
Clear-N	Force new page
Clear-Z	Enter window mode

### Delete Commands

Clear-G	Delete paragraph
Clear-L	Delete line
Clear-S	Delete spaces to left of cursor
Clear-W	Delete word

### Insert Commands

Clear-B	Insert block
Clear-L	Insert line

### Exchange Commands

Clear-B	Exchange block
Clear-G	Exchange paragraph
Clear-W	Exchange words

## Enhanced Scripsit Commands

### Disk-related

Break-Q	Query disk directory
Break-K	Kill named file

### Printer related

Break-P,Cnn	Send CHRS(nn) to printer
Break-P,T	Send top-of-form character to printer
Break-P,V	Preview text (use 0-9 to control speed, @ to pause, shift/clear to abort)

### Help Screens

Break-HK	Keyboard help file
Break-HP	Printer help file

### Bank Switching

Break-Bnn	Make memory bank nn active buffer
-----------	-----------------------------------

Table 1. ScripAid commands.

## ScripAid Commands

### Command Descriptions

\1	Set compressed-character mode
\!	Reset compressed-character mode
\2	Set double-width mode
\^	Reset double-width mode
\3	Set emphasized mode (except in compressed, sub-, or superscript modes)
\#	Reset emphasized mode
\4	Set italics mode
\\$	Reset italics mode
\5	Set underline mode
\%	Reset underline mode
\6	Set double-strike mode
\&	Reset underline, sub-, and superscript modes
\7	Set subscript mode
\`	Set superscript mode
\8	
\9	
\0	

## ScripAid Commands

### Printer Codes

\1	15
\!	18
\2	27 87 1
\^	27 87 0
\3	27 69
\#	27 70
\4	27 52
\\$	27 53
\5	27 45 1
\%	27 45 0
\6	27 71
\&	27 72 27 84
\7	27 83 1
\`	27 83 0
\8	
\9	
\0	

Table 2. Suggested control key assignments for the Epson MX-80 Type III printer.

Table 3. Definitions of the print commands.

Program Listing 1. Enhance/SRC, the source code for ScripAid enhancements.

```

00100 ;***** ENHANCE *****
00110 ;
00120 ; An enhancement package for Model 4 SCRIPSIT adding:
00130 ;    1> Directories from command line
00140 ;    2> Kill files from command line
00150 ;    3> Embedded printer control codes
00160 ;    4> Printer codes from command line
00170 ;    5> Formatted output to video monitor
00180 ;    6> Send TOP character to printer
00190 ;    7> Bank switching for 3 text buffers
00200 ;
00210 ;    8> On-line Help available
00220 ;
00230 ;
00240 ;    1. memory (clear)
00250 ;    2. load scripsit/cmd
00260 ;    3. load rekey/ovl
00270 ;    4. load enhance/ovl
00280 ;    5. dump scripaid/cmd (s=x'3800',e=x'6970',t=x'6810')
00290 ;
00300 ;*****
00310 ;
00320 ;
00330 ; Supervisor Call Equates.....
00340 DSPLY EQU 0AH ;DISPLAY A MESSAGE LINE
00350 LOGOT EQU 0CH ;DISPLAY & LOG A MESSAGE
00360 PAUSE EQU 10H ;DELAY FOR "BC" COUNTS
00370 CHNIO EQU 14H ;PASS TO NEXT MODULE IN DEV CHAIN
00380 ERROR EQU 1AH ;POST AN ERROR MESSAGE
00390 HIGH EQU 64H ;GET/PUT RIGHTS/LOWS
00400 FLAGS EQU 65H ;POINT IV TO SYSTEM FLAGS
00410 FSPEC EQU 4EH ;VERIFY FILESPEC
00420 BANK EQU 66H ;MEMORY BANK SVC
00430 FEXT EQU 4FH ;ADD FILESPEC IF NEEDED
00440 OPEN EQU 3BH ;OPEN A FILE
00450 GET EQU 03H ;GET A BYTE FROM FCB OR DCB
00460 CLOSE EQU 3CH ;CLOSE A FILE
00470 CMNDR EQU 19H ;DO CMD & RET
00480 DECHEX EQU 60H ;ASCII -> BIN IN BC
00490 PRT EQU 06H ;CHAR TO PRINTER
00500 KEY EQU 01H ;WAIT F/ KEY
00510 DSP EQU 02H ;CHAR TO VIDEO
00520 KEYIN EQU 09H ;GET A LINE (*KI)
00530 DODIR EQU 22H ;DSP DIR OF DRIVE
00540 REMOV EQU 39H ;KILL A FILE
00550 EXIT EQU 16H ;RETURN TO DOS
00560 KBD EQU 08H ;WAIT FOR KEY
00570 HEXDEC EQU 61H ;CONVERT BIN-> ASCII
00580 VDCTL EQU 0FM ;VIDEO CONTROL SVC
00590 POSN EQU 42H ;POSITION TO RECORD
00600 READ EQU 43H ;READ A RECORD (DISK)
00610 ;
00620 ;
00630 ; Scripsit Address Equates.....
00640 ;
00650 PRCALL EQU 46C9H ;LOCATION OF @PRT SVC CALL
00660 PRTCHK EQU 4AE1H ;GET *PR STATUS ROUTINE
00670 SCRIPN EQU 5416H ;NORMAL RE-ENTRY POINT
00680 ERRINV EQU 5401H ;"INVALID COMMAND" ENTRY
00690 FREND EQU 54EDH ;HOON F/ END OF PRINT ROUT
00700 SCRIPS EQU 1900H ;ENTRY TO SCRIPSIT
00710 SCRKIT EQU 383DH ;EXIT CODE
00720 DOUT EQU 5554H ;FORMATTED OUTPUT CALL
00730 KSCAN EQU 47B6H ;KBSCAN IN SCRIPSIT
00740 OLDBUF EQU 622BH ;OLD TEXT BUFFER START
00750 CKPRPM EQU 4A9CH ;CK PRINT PARMS
00760 PRPMCK EQU 4A1FH ;SCRIPSIT PRINT PARMCK
00770 BRCK EQU 40EEH ;SCRIPSIT <BRK> PARMCK
00780 BRKTAB EQU 4F6D0H ;<BRK> PARM TABLE
00790 RETBRK EQU 40F1H ;RET TO <BRK> ROUT
00800 SCRPF EQU 5F5AH ;SCRIPSIT INT DISK I/O
00810 PRRETN EQU 4BASH ;RET AFTER *PR OUT
00820 PRCLN EQU 54FC0H ;CLEAN UP AFTER *PR
00830 RETVEC EQU 5EB2H ;RETURN VECTOR
00840 WRTVID EQU 4811H ;REWRITE VIDEO IMAGE
00850 ;
00860 ;
00870 ; *** Patch Sign-on Banner ***
00880 ORG 3EFBH
00890 DEFB 78 ;LENGTH OF MESSAGE
00900 ; DEFM ' * ScripAid * - Model 4 Version 3.1 - (c) 1984 by Paladin
Software - C. Knight'
00910 *LIST OFF
00920 ; DEFM ' * ScripAid * - Model 4 Version 3.1 - (c) 1984 by Paladin
Software - C. Knight'
00930 *LIST ON
00940 ;
00950 ;
00960 ; *** Patch to eliminate reset of <BREAK> vector ***
00970 ;
00980 ORG 3906H
00990 DEFW 0000H
01000 DEFW 0000H
01010 DEFW 0000H
01020 ;
01030 ;
01040 ; *** Set jumps to extension code ***
01050 ORG PRCALL
01060 CALL PRTOUT
01070 ;
01080 ORG CKPRPH
01090 CALL CKPARM

```

Listing 1 continued



on banner, eliminate the code to reset the break vector (which creates problems with the spooler), and arranges jumps from Scripsit to ScripAid.

The initialization routine, assembled at memory address 6810 hexadecimal (hex), loads the selected or default printer driver and resets buffer pointers in Scripsit, making room for ScripAid. As the routine loads the driver codes, it saves the file name with the extension /HLP for later use as a printer Help file. The routine also verifies and initializes the optional memory buffers, if available.

The code for ScripAid actually starts at line 3050 of Program Listing 1. The PALBRK routine intercepts the break/special-command call and checks for valid ScripAid commands, such as Query, Kill, Bank, and Help. You call these by entering the first letter of each command, followed by any needed parameters.

The CKPARM routine in line 6840 of the source code parses the commands added to the Scripsit Print routine. Then ScripAid scans for Scripsit's invisible and pause commands. A reset carry flag (NC) indicates that Scripsit has located a valid parameter. Under these circumstances, ScripAid relinquishes control to the Scripsit parameter. If the Scripsit parameters aren't found, ScripAid tests for these valid ScripAid commands: video (V), top-of-form (T), and control-code output (C).

ScripAid outputs formatted text to the video by altering the output SVC number from 6 (@PRT) to 2 (@DSP), which reroutes each character to the monitor instead of to the printer port. Before output begins, however, ScripAid links to the Scripsit routine that scans for the shift-clear (abort output) key sequence. This link calls a ScripAid routine to scan for the @ key (which pauses the output) or one of the number

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01100 ;
01110     ORG     BRKCK
01120     JP      PALBRK
01130 ;
01140     ORG     SCRKIT
01150     JP      EXIT1
01160 ;
01170 ;
01180 ;
01190 ;
01200 ; *** SCRIPSIT Extension Code ***
01210 ;
01220     ORG     6810H
01230 ;
01240 ENTRY LD     (OLDSP),SP      ;SAVE STACK POINTER
01250 CALL    INITF    ;LOAD DRIVER FILE
01260 CALL    BNKONE   ;SET PTRS F/ BANK1
01270 CALL    CLRBNK   ;RESET BANKS 162
01280 JP      SCRIPS   ;GOTO SCRIPSIT
01290 ;
01300 ;
01310 ;
01320 ;
01330 INITF LD     A,(HL)      ;GET NXT CMD CHAR
01340 CALL    EDLNCK   ;END OF LINE ?
01350 JR     NZ,MOVEFSP ;NZ= FIL SPEC
01360 LD     HL,DEFNAM  ;HL-> "DEFAULT/PDC"
01370 MOVFSP LD     DE,FCB    ;DE-> PCB
01380 LD     A,FSPEC   ;SVC
01390 RST    28H
01400 JR     Z,FSPOK   ;Z= FILESPEC OK
01410 LD     HL,BADFIL ;HL-> "BAD FILE" MSG
01420 JP      LOGERR   ;GOTO LOG ERR & RET
01430 ;
01440 FSPOK LD     HL,PDCTXT ;HL-> DEFAULT EXTENSION
01450 LD     A,PEXT    ;SVC
01460 RST    28H
01470 PUSH   DE
01480 CALL    SAVFSP   ;SAVE FCB POINTER
01490 LD     HL,BANNER ;HL-> BANNER
01500 CALL    DSPMSG   ;DSPMSG-> HOLD
01510 POP    HL
01520 PUSH   HL
01530 CALL    DSPMSG   ;HL-> FILESPEC
01540 LD     C,0DH    ;C/R
01550 LD     A,DSP
01560 RST    28H
01570 POP    DE
01580 ;
01590 EXTN LD     HL,SCRPBFI ;HL-> DISK I/O BUFFER
01600 LD     B,90      ;LRL=90
01610 LD     A,OPEN    ;SVC
01620 RST    28H
01630 JP     NZ,ERR
01640 LD     HL,CTLTAB ;HL-> COMMAND TABLE
01650 ;
01660 RDLOOP LD     B,90      ;90 BYTES MAX
01670 LD     DE,FCB   ;DE-> FCB
01680 LD     A,GET    ;SVC
01690 RST    28H
01700 JR     NZ,EOP   ;ERROR COULD BE EOF
01710 LD     (HL),A
01720 INC    HL
01730 DJNZ   RDLOOP   ;STORE IN CMD TABLE
01740 ;
01750 EOF    CP     1CH      ;ERROR = EOF ?
01760 PUSH   AF
01770 LD     A,CLOSE   ;SAVE ERROR STATUS
01780 RST    28H
01790 JR     NZ,ERR
01800 POP    AF
01810 JR     NZ,ERR   ;GET ORIGINAL ERR
01820 RET
01830 ;
01840 ;
01850 SAVFSP LD     HL,PHLPFS ;HL-> HOLDING AREA
01860 SAVFSL LD     A,(DE)   ;GET A CHAR
01870 INC    DE
01880 LD     (HL),A
01890 INC    HL
01900 CP     '/'
01910 JR     NZ,SAVFSL
01920 LD     (HL),'H'
01930 INC    HL
01940 LD     (HL),'L'
01950 INC    HL
01960 LD     (HL),'P'
01970 INC    HL
01980 LD     (HL),0DH
01990 RET
02000 ; ;HLP" AS EXTENSION
02010 ;
02020 ;
02030 EDLNCK CP     0DH    ;C/R ?
02040 RET
02050 CP     03H    ;ETX
02060 RET
02070 ;
02080 ;
02090 CLRBNK LD     C,1      ;BANK 1
02100 CALL    GETCLR   ;BANK 2
02110 LD     C,2
02120 GETCLR LD     B,2      ;BANK AVAIL?
02130 PUSH   BC
02140 LD     A,BANK
02150 RST    28H

```



keys (0-9) used to control video output speed. ScripAid also bypasses the printer ready test and intercepts the end-of-output routine to restore printer output. It ignores any embedded control codes during video output.

The top-of-form (TOF) and control-code routines send characters directly to the printer. A single byte value, 0C hex, is the standard TOF code. The P,C option calls the SVC @HEXDEC, converting the ASCII decimal input to binary for output to the printer.

Line 5020 is the entry to the printer driver routine. After you save this routine, ScripAid tests the last byte sent. If it's a backslash character (\), ScripAid branches to NXTST, where it checks the current character. (To type a backslash, hit the standard slash key and the clear key at the same time.)

If the current character is something other than a backslash character, ScripAid scans the printer control code table. If ScripAid finds a match, it outputs the appropriate control string from the 90-byte control code list loaded when you called up ScripAid.

Note that ScripAid sends control codes only if the printer (SVC 6) is the active output device. This avoids confusion in the video preview mode. An invalid control code translates to a space character for printer output.

The final portion of the source code defines the messages and storage areas ScripAid uses.

## Using ScripAid

As you're writing text, you can embed ScripAid's printer codes directly in your document to activate your printer's special abilities. The Figure shows an example of text with printer codes embedded and of the final product.

ScripAid has two classes of commands: the reassigned Scripsit editing commands and the enhanced com-

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2 ANNUI Annual computation program  
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4 DAYYEAR Day of year a particular date falls on  
5 LEASEINT Interest rate on lease  
6 BREAKEVEN Break-even analysis  
7 DEPRSL Straightline depreciation  
8 DEPRSY Sum of the digits depreciation  
9 DEPRDB Declining balance depreciation  
10 DEPRDDB Double declining balance depreciation  
11 TAXDEP Cash flow vs. depreciation tables  
12 CHECK2 Prints NEBS checks along with daily register  
13 CHECKBK1 Checkbook maintenance program  
14 MORTGAGE/A Mortgage amortization table  
15 MULTMON Computes time needed for money to double, triple, etc.  
16 SALVAGE Determines salvage value of an investment  
17 RRVARIN Rate of return on investment with variable inflows  
18 RRCONST Rate of return on investment with constant inflows  
19 EFFECT Effective interest rate of a loan  
20 FVAL Future value of an investment (compound interest)  
21 PVAL Present value of a future amount  
22 LOANPAY Amount of payment on a loan  
23 REGWTH Equal withdrawals from investment to leave 0 over  
24 SIMPDISK Simple discount analysis  
25 DATEVAL Equivalent & nonequivalent dated values for oblig.  
26 ANNUDEF Present value of deferred annuities  
27 MARKUP % Markup analysis for items  
28 SINKFUND Sinking fund amortization program  
29 BONDVAL Value of a bond  
30 DEPLETE Depletion analysis  
31 BLACKSH Black Scholes options analysis  
32 STOCVAL Expected return on stock via discounts dividends  
33 WARVAL Value of a warrant  
34 BONDVAL2 Value of a bond  
35 EPSEST Estimate of future earnings per share for company  
36 BETAALPH Computes alpha and beta variables for stock  
37 SHARPEI Portfolio selection model i.e. what stocks to hold  
38 OPTWRITE Option writing computations  
39 RTVAL Value of a right  
40 EXPVAL Expected value analysis  
41 BAYES Bayesian decisions  
42 VALPRINF Value of perfect information  
43 VALADINF Value of additional information  
44 UTILITY Derives utility function  
45 SIMPLEX Linear programming solution by simplex method  
46 TRANS Transportation method for linear programming  
47 EOQ Economic order quantity inventory model  
48 QUEUE1 Single server queuing (waiting line) model  
49 CVP Cost-volume-profit analysis  
50 CONDPROF Conditional profit tables  
51 OPTLOSS Opportunity loss tables  
52 FQEOQSH Fixed quantity economic order quantity model  
53 FQEOWSH As above but with shortages permitted  
54 FQEOPB As above but with quantity price breaks  
55 QUEUECB Cost benefit waiting line analysis  
56 NCFANAL Net cash flow analysis for simple investment  
57 PROFIND Profitability index of a project  
58 CAPI Cap. Asset Pr. Model analysis of project

59 WACC Weighted average cost of capital  
60 COMPBAL True rate on loan with compensating bal. required  
61 DISCBAL True rate on discounted loan  
62 MERCANAL Merger analysis computations  
63 FINRAT Financial ratios for a firm  
64 NPV Net present value of project  
65 PRINDPAS Laspeyres price index  
66 PRINDPA Construct seasonal quantity indices for company  
67 SEASIND Time series analysis linear trend  
68 TIMETR Time series analysis moving average trend  
69 TIMEMOV Future price estimation with inflation  
70 FUPRINF Mailing list system  
71 MAILPAC Letter writing system-links with MAILPAC  
72 LETWRIT Sorts list of names  
73 SORT3 Shipping label maker  
74 LABEL1 Name label maker  
75 LABEL2 DOME business bookkeeping system  
76 BLSBUD Computes weeks total hours from time clock info.  
77 TIMECLK In memory accounts payable system-storage permitted  
78 ACCTPAY Generate invoice on screen and print on printer  
79 INVOICE In memory inventory control system  
80 INVENT2 Computerized telephone directory  
81 TELDIR Time use analysis  
82 TIMUSAN Use of assignment algorithm for optimal job assign.  
83 ASSIGN In memory accounts receivable system storage ok  
84 ACCTREC Compares 3 methods of repayment of loans  
85 TERMSPAY Computes gross pay required for given net  
86 PAYNET Compares selling price for given after tax amount  
87 SELLPR Arbitrage computations  
88 ARBCOMP Sinking fund depreciation  
89 DEPRSF Finds UPS zones from zip code  
90 UPSZONE Types envelope including return address  
91 ENVELOPE Automobile expense analysis  
92 AUTOEXP Insurance policy file  
93 INFSFILE In memory payroll system  
94 PAYROLL2 Dilution analysis  
95 DILANAL Loan amount a borrower can afford  
96 LOANAFFD Purchase price for rental property  
97 RENTPRCH Sale-leaseback analysis  
98 SALELEAS Investor's rate of return on convertible bond  
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mands I added. You invoke all of the reassigned Scripsit commands by first hitting the clear key and another key to put you in the appropriate editing mode (clear-D for delete, clear-I for insert, and so on), just as you would with the standard program. Then hit clear and the relevant command key to actually make changes (see Table 1). The reassigned Scripsit commands perform the same functions they did in the original commercial program, so I won't explain them here.

You execute all of my enhanced com-

mands by hitting the break key and an associated character or characters (see Table 1). Query (Q), clears the screen and then, like all ScripAid commands, scans the remainder of the command line for additional parameters, such as a file extension to be matched or a drive specification. Query displays the disk name, creation date, and available space for all visible, non-system files on drive zero as the default. You must specify the extension and/or drive number that you want matched. To return to ScripAid, press any key.

Kill (K) checks for the entry of a valid file name, opens the file, then calls the @REMOV SVC to kill the file from the directory of the specified or default drive. Note that you must first open, like all ScripAid commands, to remove it. When you finish editing text and want to preview what it will look like when it's printed out, press the clear-P-V keys.

Bank (B), followed by any digit from 1 to 3, incorporates the specified 32K memory bank as the active text buffer. Bank 1 is the active bank at power-up and has the largest capacity (35K to 39K depending on your system configuration). Banks 2 and 3 each hold about 32K of text. If a requested bank isn't available, a message is displayed. When switching banks, the selected video line width and paragraph indent are saved or restored.

If you've created your own help file (see Program Listing 5), the ScripAid Help command (H), followed by K (keyboard) or P (printer), calls for the appropriate help screen. These are stored as ASCII files with a record length of 80 bytes. The up- and down-arrow keys page forward and backward through the help file. You should note that the letter H, when not followed by another character, calls for the hyphenation command.

## End Notes

As with any enhancement program, it's necessary to create the enhanced commands around the original program. Whenever you do this, however, you must make some compromises, and ScripAid has two of which you should be aware.

The first problem is that the embedded printer control codes aren't treated as invisible format commands by Scripsit's formatting routines. Because of this, full justification (flush-left and -right margins) won't function properly with embedded codes. To eliminate this problem, you can turn off full justification (J=N) and carefully assemble any lines using special functions.

The second problem concerns text that's previewed on the monitor with the P,V command. If the text contains page number blocks, it's video display is marred by momentary flashes of the editing screen whenever it calculates a new page number. You can avoid this problem by leaving out page number blocks until you're ready to print the document. ■

You can write to Clifford Knight at Box 253, Manomet, MA 02345.

*Listing 1 continued*

```

02160 POP BC ;GET #
02170 RET NZ ;NZ=NOT AVAIL
02180 LD B,0 ;SELECT BANK
02190 LD A,BANK
02200 RST 28H
02210 PUSH BC ;SAVE OLD BANK
02220 LD A,8CH
02230 LD (8009H),A ;INTO BUFFER
02240 XOR A
02250 LD (8001H),A ;NO TEXT
02260 POP BC ;GET OLD BANK #
02270 LD A,BANK ;@BANK SVC
02280 RST 28H
02290 RET ;DONE
02300 ;
02310 ;
02320 ;
02330 ;BADFIL DEFN 'Invalid filespec!'
02340 ; DEFB 0DH
02350 *LIST OFF
02360 BADFIL DEFN 'Invalid filespec!'
02370 DEFB 0DH
02380 *LIST ON
02390 ;
02400 ;
02410 DSPMSG PUSH DE ;SAVE DE
02420 LD A,DSPLY ;SVC, DISPLAY MSG @ (HL)
02430 RST 28H
02440 POP DE
02450 RET Z ;Z= O.K.
02460 LD L,A ;L= ERROR CODE
02470 LD H,00H
02480 OR 0CH ;SET RETURN BITS
02490 ERR LD C,A ;PASS IN "C"
02500 LD A,ERROR ;SVC, LOG AN ERROR
02510 RST 28H
02520 JR DOSXIT ;RET W/ ERROR
02530 ;
02540 ;
02550 LOGERR LD A,LOGOT ;SVC, DISPLAY & LOG MSG
02560 RST 28H
02570 LD HL,0FFFFH ;SET ERROR RETURN
02580 DOSXIT LD SP,$-2 ;RESET SP
02590 OLDSP EQU $-2 ;GOTO DOS READY
02600 RET
02610 ;
02620 ;
02630 FCB DEFS 32 ;PCB FOR PDC INPUT
02640 ;DEFNAM DEFN 'DEFAULT/'
02650 ;PDCTXT DEFN 'PDC'
02660 ; DEFB 0DH
02670 *LIST OFF
02680 DEFNAH DEFN 'DEFAULT/'
02690 PDCTXT DEFN 'PDC'
02700 DEFB 0DH
02710 *LIST ON
02720 ;
02730 ;BANNER DEFB 0FH ;CURSOR OFF
02740 ; DEFB 1CH ;HOME CURSOR
02750 ; DEFB 1FH ;CLS
02760 ; DEFB 0CDH
02770 ; DEFM '*** ScripAid *** (c) 1984 Paladin'
02780 ; DEFM ' Software'
02790 ; DEFW 0AAAH
02800 ; DEFW 0ABAH
02810 ; DEFW 0ABAH
02820 ; DEFB 0D4H
02830 ; DEFM 'Loading driver --> '
02840 ; DEFB 03H
02850 *LIST OFF
02860 BANNER DEFB 0FB
02870 DEFB 1CH
02880 DEFB 1FH
02890 DEFB 0CDH
02900 DEFM '*** ScripAid *** (c) 1984 Paladin Software'
02910 DEFW 0AAAH
02920 DEFW 0AAAH
02930 DEFW 0AAAH
02940 DEFB 0D4H

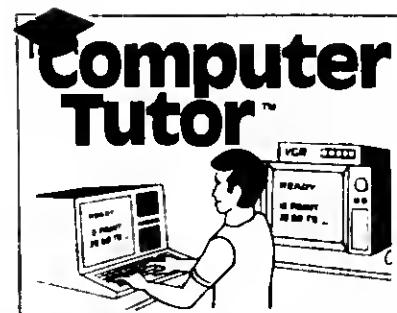
```

*Listing 1 continued*

Listing 1 continued

```
02958      DEFM    'Loading driver --> '
02960      DEFB    03H
02970 *LIST ON
02980 ;
02990 ENINIT EQU     S
03000 ;
03010 ;
03020 ;
03030 ;     *** Start of ScriptAid ***
03040 ;
03050      ORG     OLDBUF      ;STARTS @ OLD TEXT BUF
03060 ;
03070 PALBRK INC     HL      ;HL-> NEXT CHAR
03080 CP      'Q'      ;QUERY?
03090 JR      Z,QUERY      ;IF SO
03100 CP      'K'      ;KILL ?
03110 JP      Z,KILL      ;DO IT
03120 CP      'B'      ;BANK?
03130 JP      Z,BANKS      ;GO TO IT
03140 CP      'H'      ;HELP?
03150 JR      NZ,GOODBK      ;NZ= NOT "H"
03160 LD      C,A      ;ELSE SAVE CHAR
03170 LD      A,(HL)      ;GET NEXT CHAR
03180 CP      0DH      ;CR?
03190 JP      NZ,HELP      ;IF NOT, GET HELP
03200 LD      A,C      ;GET ORIG CHAR
03210 GOODBK LD      HL,BRKTAB      ;HL-> BRK PARMs
03220 JP      RETBRK      ;GO BACK
03230 ;
03240 ;
03250 QUERY CALL    SKFSPL+1      ;SKIP SPACES
03260 JR      Z,NOEXT      ;Z= CR FOUND
03270 CP      '/'      ;EXT SPECIFIED?
03280 CALL    Z,MOVEEXT      ;IF FOUND
03290 JR      Z,USREXT
03300 NOEXT PUSH    HL      ;SAVE CMDLINE PTR
03310 LD      HL,EXTMSG-1      ;HL-> " $$ "
03320 CALL    MOVEEXT
03330 POP     HL      ;GET PTR
03340 USREXT LD      A,(HL)      ;GET A CHAR
03350 CP      ':'      ;DRIVE SPECIFIED?
03360 INC     HL
03370 JR      Z,USRDRV      ;IF SO
03380 CP      0DH      ;CR?
03390 JR      NZ,USREXT      ;IF NOT EOLN
03400 LD      (HL), '0'      ;SET DRV 0
03410 USRDRV CALL    CLRVID      ;CLEAN VIDEO
03420 LD      A,(HL)      ;GET DRIVE #
03430 AND     07H      ;8-7 ONLY
03440 LD      C,A      ;INTO C
03450 LD      (PARM1),A      ;SAVE DRIVE #
03460 LD      HL,SCRPBFI      ;HL-> BUFFER AREA
03470 LD      B,04      ;SET GET FREE
03480 LD      A,DODIR      ;@DODIR SVC
03490 RST     28H
03500 JP      NZ,DSKERR
03510 LD      HL,DRVMSG      ;HL-> "DRIVE: "
03520 LD      A,DSPLY
03530 RST     28H
03540 LD      A,(PARM1)      ;GET DRIVE #
03550 ADD     A,30H      ;CONV TO ASCII
03560 LD      C,A
03570 LD      A,DSPL
03580 RST     28H
03590 LD      HL,NAMSG      ;HL->"Pack ID: "
03600 LD      A,DSPLY
03610 RST     28H
03620 LD      HL,SCRPBFI      ;HL-> FREE STRING
03630 CALL    EIGHT      ;OUTPUT DISK NAME
03640 PUSH    HL      ;SAVE DISK INFO PTR
03650 LD      HL,CREMSG      ;HL->"Created: "
03660 LD      A,DSPLY
03670 RST     28H
03680 POP     HL      ;GET INFO PTR
03690 CALL    EIGHT      ;OUTPUT CREATION DATE
03700 PUSH    HL      ;SAVE INFO PTR
03710 LD      HL,FREMSG      ;HL->"Free: "
03720 LD      A,DSPLY
03730 RST     28H
03740 POP     HL
03750 LD      E,(HL)      ;LSB TOTAL SPACE
03760 INC     HL
03770 LD      D,(HL)      ;MSB TOTAL
03780 INC     HL      ;HL-> LSB FREE
03790 LD      A,(HL)      ;GET LSB
03800 INC     HL
03810 LD      H,(HL)      ;GET MSB
03820 LD      L,A      ;HL= FREE SPACE
03830 PUSH    DE      ;SAVE TOTAL
03840 CALL    KOUT      ;OUTPUT FREESP
03850 LD      C,/**
03860 LD      A,DSPL
03870 RST     28H
03880 POP     DE      ;GET TOTAL
03890 EX      DE,HL
03900 CALL    KOUT
03910 LD      HL,BLKLIN      ;HL-> @A0DH
03920 LD      A,DSPLY
03930 RST     28H
03940 LD      A,(PARM1)      ;GET DRIVE #
03950 LD      C,A      ;INTO C
03960 LD      B,2      ;SET DIR F/ "EXT"(HL)
03970 LD      HL,EXTBUF      ;HL-> EXTENSION TO MATCH
03980 LD      A,DODIR
03990 RST     28H      ;DIR TO VIDEO
```

Listing 1 continued



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Listing 1 continued

```

04800  JR    NZ,DSKERR
04810  CALL  BOTLIN
04920  LD    RL,VDMSG
04830  LD    A,DSPLY
04840  RST   28H
04850  ;
04860  ;
04870  ;
04880  WAITBK LD    A,KEY    ;@KEY SVC
04890  RST   28H
04180  GOBACK LO   C,0FH    ;CURSOR OFF
04110  LO   A,DSPL
04120  RST   28H
04130  CALL  CLRVID
04140  JP    SCRPN    ;CLEAR SCREEN
04150  ;
04160  ;
04170  RILL  CALL  SKPSPL+1 ;SKIP SPACES
04180  JR    Z,GOERR
04190  LO   DE,PCB1
04200  LD    A,FSPEC
04210  RST   28H
04220  JR    NZ,DSKERR
04230  LD    B,0    ;LRL=256
04240  LD    A,OPEN
04250  RST   28H
04260  JR    NZ,DSKERR
04270  LO   A,REMOV
04280  RST   28H
04290  JR    NZ,DSKERR
04300  JR    GOBACK
04310  ;
04320  ;
04330  GOERR  LD    C,0FH    ;CURSOR OFF
04340  LD    A,DSPL
04350  RST   28H
04360  JP    ERRINV   ;INVALID CMD
04370  ;
04380  ;
04390  ;
04400  DSRERR OR    0C9H    ;SET RET & MSG
04410  LD    C,A    ;ERROR -> C
04420  PUSH  BC    ;SAVE ERROR
04430  CALL  BOTLIN
04440  POP   BC    ;POSITION CURSOR
04450  LD    A,ERROR
04460  RST   28H
04470  JR    WAITBK
04480  ;
04490  ;
04500  TOP   POP   HL    ;FIX STACK
04510  LD    C,0CH
04520  LD    A,PRT
04530  RST   28H
04540  JR    GOBACK
04550  ;
04560  CTRL  POP   AF    ;FIX STACK
04570  INC   HL    ;HL-> NEXT CHAR
04580  CTLPL1 CALL  SKPSPL+1 ;SKIP SPACES
04590  JP    Z,GOBACK
04600  CP    ,
04610  JR    NZ,CONT1
04620  INC   HL    ;IF END
04630  CONT1 LD    A,DECHEX
04640  RST   28H
04650  LD    A,PRT
04660  RST   28H
04670  JR    CTLPL1
04680  ;
04690  VIDEO LD    A,02H    ;@DSP SVC
04700  LD    (OUTSVC),A
04710  LD    A,0E9H
04720  LD    (PASRST),A
04730  LD    HL,0C9AFH
04740  LD    (PRTCHK),HL
04750  LD    HL,VDWAIT
04760  LD    (PRENO),HL
04770  LD    A,0CDH
04780  LD    (KSCAN),A
04790  LD    HL,DLYCK
04800  LD    (KSCAN+1),HL
04810  CALL  BOTLIN
04820  OR    A
04830  RET   ;
04840  ;
04850  ;
04860  ;
04870  PRTCNT LD    A,06H    ;@PRT SVC
04880  LD    (OUTSVC),A
04890  LD    HL,0D5C5H
04900  LD    (PRTCHK),HL
04910  LD    HL,00UT
04920  LD    (PRENO),HL
04930  LD    A,28H
04940  LD    (KSCAN),A
04950  LD    HL,0AF02H
04960  LD    (KSCAN+1),HL
04970  XOR   A
04980  LD    (PASRST),A
04990  RET   ;
05000  ;
05010  ;
05020  PRTOUT PUSH  HL    ;SAVE CURRENT CHAR
05030  PUSH  DE
05040  PUSH  AF    ;SAVE ACCUM
05050  PUSH  BC

```

Listing 1 continued

```

05860 LD A,$-$ ;GET PREV CHAR
05878 PRVCHR EQU $-1
05888 CP '\';;"\"?
05890 LD A,C ;GET CURRENT CHAR
05100 JR Z,NXTST ;IP PREVIOUS-"\"
05110 SAVPRV CP '\'
05120 LD (PRVCHR),A ;SAVE AS PREVIOUS
05130 JR Z,PRTXIT ;IF CURR-"\", NO ACT
05140 NOSET LD BC,0381N ;DELAY COUNT
05150 LD A,PAUSE ;PAUSE SVC
05160 PASRST NOP ;INIT IN "PRINT"
05170 POP BC ;GET CHAR
05180 PUSH BC ;SAVE AGAIN
05190 LD A,PRT ;&PRT SVC
05200 OUTSVC EQU $-1
05210 RST 2BH
05220 PRTXIT POP BC ;RESTORE ACCUM
05230 SKPQUT POP AF ;GET DE
05240 POP DE ;GET NL
05250 POP NL ;DONE
05260 RET
05270 ;
05280 ;
05290 NXTST CP '\';;2nd "\"??
05300 JR NZ,CTLCK ;IP SO
05310 SAVSPC LD A,2BH
05320 JR SAVPRV ;SAVE AS PREV
05330 ;
05340 ;
05350 CTLCK LD A,(OUTSVC) ;GET OUTPUT SVC
05360 CP 02H ;EDSP?
05370 POP BC ;GET CURRENT CHAR
05380 JR NZ,CTLCN1 ;NZ=&PRT
05390 LD A,2BH ;ASCII SPACE
05400 LD (PRVCHR),A ;SAVE AS PREVIOUS
05410 JR SKPQUT ;SKIP OUTPUT
05420 ;
05430 ;
05440 ;
05450 CTLCN1 LD NL,CTLTAB ;HL-> CTL STRINGS
05460 LD DE,LOOKTB ;DE-> LOOKUP TABLE
05470 LD B,18 ;18 CODES
05480 LOOKLP LD A,(DE) ;GET ONE
05490 INC DE ;DE-> NEXT CODE
05500 CP C ;MATCH?
05510 JR Z,CTLFND ;IF SO
05520 INC NL
05530 INC BL
05540 INC NL
05550 INC HL ;5 BYTES/ENTRY
05560 INC BL ;HL-> NEXT CTL STRS
05570 DJNZ LOOKLP ;LOOP
05580 LD C,2BH ;ELSE PASS A SPACE
05590 CHRNUL PUSH BC ;SAVE AS CURRENT
05600 JR SAVSPC ;GO DO IT
05610 ;
05620 CTLFND LD B,05H ;5 BYTES/CTL $
05630 CTLLOOP LD C,(BL) ;GET ONE
05640 INC HL ;HL-> NEXT
05650 INC C
05660 JR Z,CTLDON ;Z= END OF CTL$
05670 DEC C ;RESTORE
05680 LD A,PRT ;&PRT SVC
05690 RST 2BH
05700 DJNZ CTLLOOP ;LOOP
05710 ;
05720 CTLDON XOR A ;CLEAR ACCUM
05730 LD C,A ;SET A NULL
05740 JR CNRNUL ;OUTPUT NULL, SAVE - -
05750 ;
05760 ;
05770 DLYCK JR NZ,CKCN1 ;IF NOT <SFT><CLR>
05780 CALL PRTCNT ;RESET *PR DPUT
05790 LD HL,PRRETN ;HL-> CONT ROUT
05800 LD (RETVEC),HL ;INTO RET VECTOR
05810 JP PRCLN ;CONTINUE
05820 ;
05830 CKCN1 CP '!' ;PAUSE ?
05840 JR NZ,CRCN2 ;IF NOT
05850 PUSH DE ;SAVE TEXT PTR
05860 LD A,KEY ;&KEY SVC
05870 RST 2BH ;WAIT
05880 POP DE
05890 CKCN2 SUR 30H ;CONVERT TO DEC
05890 JR C,NOTNUM ;>"9"?
05910 CP 0AH
05920 JR NC,NOTNUM ;INTO CODE ABOVE
05930 LD (NOSET+2),A
05940 NOTNUM XOR A
05950 RET
05960 ;
05970 ;
05980 CLRVID PUSH HL ;HL-> CLMSG
05990 LD HL,CLRMSG ;HL-> CLS STRING
06000 LD A,DSPLY
06010 RST 2BH
06020 POP HL
06030 RET ;DONE
06040 ;
06050 ;
06060 ;
06070 VDWAIT CALL DOUT ;DO OUTPUT
06080 PUSH DE
06090 PUSH HL ;SAVE REGS
06100 CALL BOTLIN ;POS'N CURSOR

```

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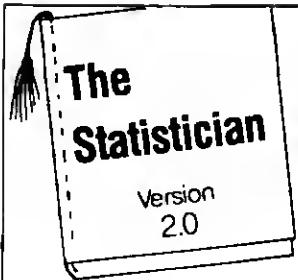
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*Listing 1 continued*

```

06118  EI
06120  LD  HL,VDMSG ;HL-> HIT RET TO CONT
06130  LD  A,DSPLY
06140  RST 2BH
06150  LD  A,KEY ;KEY
06160  RST 2BH
06170  LD  C,BPH ;CURSOR OFF
06180  LD  A,DSP ;PDSP SVC
06190  RST 2BH
06200  POP  HL
06210  POP  DE
06220  JP  FRTCNT
06230 ;
06240 ;
06250 EIGHT LD  B,B ;8 BYTES
06260 EILOOP LD  C,(HL) ;GET A BYTE
06270 LD  A,DSP
06280 RST 2BH
06290 INC  HL ;HL-> NEXT BYTE
06300 DJNZ EILOOP
06310 RET
06320 ;
06330 ;
06340 ROUT LD  DE,SCRPB ;DE-> BUFFER
06350 PUSH DE ;SAVE BUFFER START
06360 LD  A,HEXDEC
06370 RST 2BH
06380 POP  HL
06390 LD  B,5 ;HL-> BUFFER
06400 CALL EILOOP ;OUTPUT 5 BYTES
06410 LD  C,'K'
06420 LD  A,DSP
06430 RST 2BH
06440 RET
06450 ;
06460 ;
06470 MOVEXT PUSH AF ;SAVE CHAR
06480 LD  B,3 ;3 CHARS/EXT
06490 LD  DE,EXTBUF ;DE-> EXT BUFFER
06500 EXTLB INC  HL ;BUMP PTR
06510 LD  A,(BL) ;GET A CMDLINE CHAR
06520 CP  '8'
06530 JR  C,FILLUP ;C= <"8"
06540 CP  '9'+1 ;C= "8"- "9"
06550 JR  C,OKEXT ;FOLD -> U/C
06560 AND  SFH
06570 CP  'A'
06580 JR  C,FILLUP ;C= >"9", <"A"
06590 CP  '2'+1 ;NC= >"Z"
06600 JR  NC,FILLUP ;INTO BUFFER
06610 OKEXT LD  (DE),A ;BUMP PTR
06620 INC  DE ;BUMP PTR
06630 DJNZ EXTLB ;LOOP
06640 POP  AP
06650 RET
06660 ;
06670 FILUP LD  A,'$' ;WCC
06680 DEC  HL ;BACKUP PTR
06690 JR  OKEXT
06700 ;
06710 ;
06720 ;
06730 ;
06740 BOTLIN LD  RL,17088 ;LINE 23, COL 8
06750 LD  B,83H ;SET CURSOR OF
06760 LD  A,VDCTL ;PVDCCTL SVC
06770 RST 2BH
06780 LD  C,1EH ;CLEAR TO END OF LINE
06790 LD  A,DSF ;PDSP SVC
06800 RST 2BH
06810 RET
06820 ;
06830 ;
06840 CKPARM PUSH DE ;SAVE CMD LINE PTR
06850 CALL PRPHCK ;LOOK F/, P, I ETC
06860 POP  HL ;HL-> CMD LINE
06870 RET  NC ;NC= PARM FOUND
06880 LD  A,(HL) ;ELSE GET NEXT CHAR
06890 CP  'V' ;VIDEO ?
06900 JP  Z,VIDEO ;IF SO
06910 CP  'T' ;TOP OF FORM ?
06920 JP  Z,TOP
06930 CP  'C' ;CONTROL CODES?
06940 JP  Z,CTRL ;ELSE SET CARRY
06950 SCF
06960 RET ;DONE
06970 ;
06980 ;
06990 HELP CALL SKPSPC ;SKIP SPACES
07000 SUB  'P' ;PRINTER HELP?
07010 LD  RL,HLPPFS ;BL-> REG HELPPFS
07020 LD  A,11 ;12 PAGES IN MAIN HELP
07030 JR  NZ,GETHLP ;NZ= NOT *PR BLP
07040 LD  BL,PHLPPFS ;BL-> PRINTER FS
07050 XOR  A ;MAX PAGE=0
07060 GETHLP LD  (MAXPAG),A ;SAVE MAX PAGE #
07070 LD  DE,FCB1 ;DE-> FCB
07080 LD  A,FSPEC ;FSPEC
07090 RST 2BH
07100 JP  NZ,DSKERR
07110 LD  A,OPEN ;OPEN
07120 LD  B,88 ;88 BYTE LRL
07130 LD  HL,SCRPB ;HL-> BUFFER
07140 RST 2BH
07150 JP  NZ,DSKERR ;CURRENT PAGE = 8
07160 PAGE0 XOR  A

```

*Listing 1 continued*

```

87170 SAVPAC LD (PARM1),A ;SAVE CURR PAGE *
87180 CALL DSPPAG ;OUTPUT A PAGE
87190 JP NZ,DSKERR
87200 CALL BOTLIN ;CURSOR @ LINE 23
87210 LD HL,HLPMSG
87220 LD A,DSPLY ;#DSPLY
87230 RST 28H
87240 HLPLP LD A,KEY ;#KEY
87250 RST 28H
87260 CP 0AH ;DOWN ARROW
87270 RST 28H
87280 CP 0AH ;DOWN ARROW
87290 JR Z,NXTPAG
87300 CP 0AH ;UP ARROW ?
87310 JR NZ,HLPLP ;LOOP IF NOT
87320 LD DE,FCB1
87330 LD A,CLOSE
87340 RST 28H
87350 JP NZ,DSKERR
87360 JP GOBACK
87380 ;
87400 PRVPAG LD A,(PARM1) ;GET CURR PAGE *
87410 OR A ;TEST IT
87420 JR NZ,DECpag ;NZ, CURR<>0
87430 LD A,(MAXPAG) ;ELSE GET LAST *
87440 INC A
87450 DECpag DEC A
87460 JR SAVPAG ;GO TO IT
87470 ;
87480 NXTPAG LD HL,MAXPAG ;HL-> MAXPAGE *
87490 LD A,(PARM1) ;A= CURR *
87500 CP (HL) ;TEST
87510 JR Z,PAGE0 ;IF AT MAX
87520 INC A ;ELSE BUMP *
87530 JR SAVPAG ;DO IT
87540 ;
87550 DSPPAG SLA A ;A= PAGE*4
87560 SLA A ;SAVE IT
87570 LD C,A ;A= PAGE*16
87580 SLA A ;A= PAGE*20
87590 SLA A ;INTO C
87600 ADD A,C ;BC= REC *
87610 LD C,A
87620 LD B,08H ;DE-> PCB
87630 LD DE,FCB1 ;DE-> PCB
87640 LD A,POSN ;POSN SVC
87650 RST 28H
87660 RET NZ
87670 CALL CLRVID
87680 LD B,20 ;20 LINES/PAGE
87690 PAGLP PUSH BC ;SAVE LINE COUNT
87700 LD DE,FCB1
87710 LD A,READ ;#READ
87720 LD HL,LINBUF ;#CHAR BUFFER
87730 PUSH HL ;SAVE IT
87740 RST 28H
87750 POP HL ;HL-> LINE START
87760 LD A,0DH ;C/R
87770 LD (LINBUF+79),A ;FLAG END OF LINE
87780 LD A,DSPLY ;#DSPLY
87790 RST 28H
87800 POP BC ;GET COUNT
87810 DJNZ PAGLP ;ELSE DONE
87820 RET
87830 ;
87840 ;
87850 BANKS CALL SKPSPL+1 ;GET NEXT & SKIP **
87860 SUB 31H ;CONVERT TO BINARY
87870 JR C,BNKERR
87880 CP 03H ;>"2"?
87890 JR NC,BNKERR
87900 LD C,A ;GET BANK # IN C
87910 PUSH BC ;SAVE IT
87920 LD B,02 ;BANK AVAIL?
87930 LD A,BANK ;#BANK SVC
87940 RST 28H
87950 POP BC ;#IX STACK/GET BANK#
87960 JR NZ,BNKERR ;IF ERROR
87970 PUSH BC ;SAVE IT
87980 ;
87990 LD HL,CSRET ;HL-> RET ADDR
88000 PUSH HL ;SET SAME
88010 LD A,1BH ;<SHFT<UP>
88020 JP 398EH ;GO DO IT
88030 ;
88040 CSRET LD (5ECH),DE ;SAVE CURRENT LOC
88050 CALL BNK23 ;SET PTRS
88060 POP BC ;GET BANK #
88070 LD A,C ;INTO A
88080 PUSH BC ;SAVE AGAIN
88090 OR A ;TEST IT
88100 CALL Z,BNKONE ;IF Z, SPECIAL RESET
88110 LD A,(CURBNK) ;GET CURRENT BANK
88120 CALL FNDBNK ;HL-> STRG AREA
88130 SVBNKL LD E,(IX+8) ;DE-> ADDR TO MOVE
88140 LD D,(IX+1) ;MOVE IT
88150 CALL MOVPTR ;LDOP
88160 DJNZ SVBNKL ;GET REQUESTED BANK#
88170 POP BC ;SAVE AGAIN
88180 PUSH BC ;SET SELECT FUNCTION
88190 LD B,0 ;#BANK SVC
88200 LD A,BANK ;SET NEW BANK
88210 RST 28H ;RESET "OLD" BANK
88220 LD B,1 ;RESET "OLD" BANK

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Program Listing 2. Retkey/SRC, the source code for keyboard and message modifications.

```

110116 FRENMSG DEFN BC3H
110120 DEFH 'Free: '
110132 DEFB B3H
110138 DEFB 'SSS'
110139 DEFB 'Use up/down arrows to page, <BREAK> to
110139 DEFB 'return to ScriptAID...'

110135 DEFB BEX
110136 DEFB B3H
110137 DEFB 'ScriptAID/HLP'
110138 DEFB BDX
110139 DEFB 'ScriptAID/HLP'

```

*listing 2 continued*





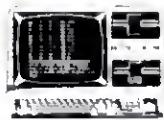
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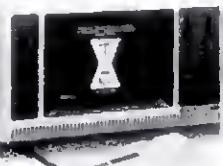


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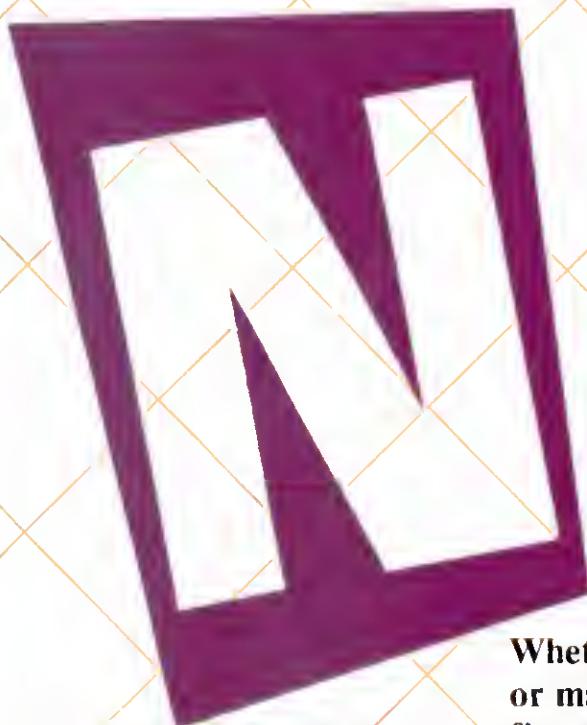


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# NOVACALC

Whether you're making five-year fiscal projections or managing your home budget, NovaCalc tracks your finances with all the features of a commercial spreadsheet.

by Daniel Girms

**F**orget your balance sheets and home-budget programs. Here's a full-featured, menu-driven Model I/III spreadsheet that gives you all the capabilities of its commercial counterparts, including a rapid-entry mode that lets you enter information into the spreadsheet without waiting for the program to recalculate related values.

NovaCalc also totals and averages a series of cells and has a built-in four-function calculator that lets you make calculations before entering the results in the spreadsheet. It accepts label (text), numeric, and formula entries of up to 12 characters.

## Operating NovaCalc

When you run NovaCalc, it prompts you to select 1-, 2-, 3-, or 4-digit precision and to choose from four spreadsheet formats (24 columns by 26 rows, 16 by 39, 12 by 52, or 8 by 78). NovaCalc then displays the spreadsheet with a command prompt and cell status line at the top of the screen.

NovaCalc provides a total of 624 cells. You identify cells by column and row. For example, A01 represents the cell at column A, row 1. Use the arrow keys to move the cell pointer (cursor) from cell to cell.

The slash key (/) puts NovaCalc in the command mode. Press this key and a list of commands appears at the screen top. NovaCalc supports 13 commands (see Table 1). You invoke the desired command by pressing its first character.

The clear key is the escape character. Press it to cancel the current routine and return to the spreadsheet. When used in the rapid-entry mode, the clear key cancels the current routine and updates the spreadsheet for all previous entries made in this mode.

The rapid-entry mode works when you enter data or use the calculator routine. Hit any arrow key instead of the enter key to make another entry without recalculating all the affected cells.

The contents of the cell at the cursor position appear on the cell status line as you make an entry. To recalculate the spreadsheet after an entry, hit the enter key.

Pressing the clear key or executing any command except Alpha, Value, or Calculator (described below) exits the rapid-entry mode and recalculates the spreadsheet. The program also exits the mode if the cursor scrolls to a column or row that's off-screen.

## Labeling Cells

You use the Alpha command (A) to label a cell. When you invoke this command, the cell status line displays a lowercase (a) at the top of the screen and in the cell. However, this simply serves as an indicator; you still have all 12 character spaces available for entering text.

Type in your entry at the prompt and press the enter key to update the spreadsheet or the clear key to cancel the entry.

You can enter any combination of alphanumeric characters as a label ex-

cept an open parenthesis or quotation marks. NovaCalc's value interpretation routine uses an open parenthesis to detect alpha entries. Basic uses quotation marks as delimiters when separating and storing string variables, and NovaCalc saves all variables as strings.

You can't combine cells with label entries in mathematical functions, but you can use label cells in a column or row without affecting the total. The program's value interpretation routine sets the value of any alpha or blank cell to zero.

## Blanking Out Cells

Blank (B) deletes the contents of a cell. It erases cell formulas and values and updates the spreadsheet.

If the cell you're blanking out derives from a formula in another cell, that formula remains unaffected, but the value of the blanked cell equals zero.

## Copying Values

The Copy command (C) copies a cell's value to other cells so you don't have to reenter information. Copy can also link cells so that NovaCalc updates them whenever the source cell changes.

To link cells, type Y at the link prompt, or type N to copy without linking. Once linked, the destination cells contain a value like A01C, for example. A01 represents the source cell and C instructs the value interpretation routine to get the spreadsheet value from the source cell.

Command	Description
Alpha	Alpha command for entering label data
Blank	Blank command clears cell and deletes formula used to create it
Copy	Copy command copies value of one cell to another cell
Delete	Delete command erases cell formula while retaining cell's value
Go To	GOTO command positions cursor at specified cell location
Help	Help command displays explanations for all NovaCalc commands
Load	Load command loads saved spreadsheets
Print	Prints out the portion of the spreadsheet on the screen
Quit	Quit command ends session and prompts you to save data
Replicate	Replicate command projects and modifies over a series of cells
Save	Save command saves data to disk
Value	Value command for entering formulas and values
Calculate (=)	Activates four-function calculator

Table 1. Commands for NovaCalc.

You can't link alpha cells; the program unlinks any cell containing an alpha value prior to copying it to a new location.

The next prompt asks you if you want the cell copied to another cell location (C), or copied several locations down (D) or right (R).

The C option displays the current cursor location followed by an equals sign. You enter the target location. For example, entering A02 at this prompt copies the current cell to the second row of column A and updates the spreadsheet.

When you copy down or right, the program asks you how many times you want to copy the cell. Enter a number and hit the enter key. The program copies the value of the current cell location down or right the specified number of times and updates the screen.

## Deleting Formulas

Delete (D) erases the formula used to calculate a cell without removing the cell's current value. It's useful for unlinking cells created with the Copy command. Press the D key to delete the formula and update the spreadsheet.

## The GOTO Command

The GOTO command (G) lets you move the cursor to any cell by entering its location. This saves moving through the spreadsheet with the arrow keys. GOTO is especially useful when you want to move to a cell that's off-screen, or when you want to print a specific area of the spreadsheet.

GOTO prompts you for a cell location, then makes that location the upper left-hand cell on the display. For example, typing H, 1, and 7 resets the display to show columns H, I, J, and K and rows 17-29. If the cell specified is too far down to display a full screen, Nova-

Calc doesn't print the cell in the upper left-hand corner; instead, it marks the position with the cursor and displays a full screen.

Press the clear key to cancel GOTO and recalculate the spreadsheet. If you specify a cell location outside the limits of the spreadsheet, the program displays an "Entry Error" message and stays at the current cell location.

## The Help Command

The Help command (H) lists NovaCalc's commands and gives you a short definition of each. Press the clear key to return to the spreadsheet.

## Loading a Spreadsheet

To load files from disk, press the L key. Enter the appropriate file number (1-9) at the prompt. The message "Loading" appears on the screen as the file loads.

When the program finishes loading, it recalculates the spreadsheet and resets the cursor position to cell A01.

NovaCalc saves spreadsheet cells in an order dependent on the number of rows and columns. Before loading a file, be sure to choose the appropriate spreadsheet format. Otherwise, cells can reference formulas that don't exist.

## Printing Spreadsheets

The Print command (P) prints out the portion of the spreadsheet on the display (four rows and 13 columns). You can print the values or the formulas.

Print prompts you to hit the enter key when the printer is ready. To cancel the Print command, press the clear key.

The program next asks you to press the D key to print display values, or the F key to print formulas. Press the appropriate key and hit the enter key. The program displays a "Printing" message and prints the spreadsheet.

## Ending a Session

To end a session or restart the program, press the Q key. Quit prompts you to save data before ending the session.

The program then branches to the Save routine or prompts you to return to the spreadsheet (R), create a new spreadsheet (C), or exit to Basic ready (E).

## The Replicate Command

The Replicate command projects and modifies a formula over a series of cells. This saves you from entering similar formulas in contiguous cells. Replicate works down or to the right.

For example, assume columns A, B, and C are labeled Income, Expenses, and Remaining Amount, and the formula for cell C01 is C01 = A01 - B01. If rows 1-12 represent January through December, and you want the same formula for each month, you must type C02 = A02 - B02, C03 = A03 - B03, and so on.

To do this automatically, type in R to enter the Replicate routine, then type D at the prompt for down, and 11 at the prompt for the number of times you want to replicate the formula.

If the number of rows or columns specified exceeds the number of remaining rows or columns in the spreadsheet, the program adjusts your entry before executing the command.

To replicate a formula to all remaining cells, enter any number exceeding the number of columns or rows in the spreadsheet. Press the clear key to cancel Replicate.

## Saving Spreadsheets

The Save command (S) lets you save up to nine spreadsheet templates and data. The routine prompts you to save the file to a number from 1-9. Select a number or press the clear key to return to the command prompt.

NovaCalc displays a "Saving" message as it saves the spreadsheet to disk, then prompts you to return to the spreadsheet (R), create a new spreadsheet (N), or exit the program (E).

## The Value Command

The Value command lets you enter numeric values or formulas. To make an entry, press the V key, type in the

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numeric value or formula and hit the enter key.

NovaCalc accepts any positive or negative number value as numeric input. Input numeric values requiring a mathematical operator with the Calculator routine.

To input a numeric value, type in the value and hit any arrow key to continue or the enter key to recalculate.

NovaCalc formulas add, subtract, multiply, or divide two cells or a cell and a numeric value. To build a formula, move the cursor to the cell where you want the result to appear. The cell location appears at the screen top in the format A01 = .

Type in a cell location, a mathematical operator, and a numeric value, or a cell location. Now hit the enter key and the program calculates the value and puts it in the cell.

NovaCalc retains the formula used to calculate the cell and displays it on the cell status line when you position the cursor at the cell. The program updates the display for formula changes when it recalculates the spreadsheet.

In addition to the four mathematical operators listed above, NovaCalc also totals (T) or averages (A) a series of cells (see Table 2 for a list of mathematical functions).

To total a series of cells in the same

column or row, enter a starting cell location, press the T key, enter an ending cell location, and hit the enter key.

The program adds the contents of the cell locations from the starting cell to the ending cell and puts the result at the cursor location.

To average a series of cells in the same column or row, enter a starting cell location, type A, enter an ending cell location, and hit the enter key.

NovaCalc averages all cells from the first to the second location and displays the results at the cursor location.

## Using the Calculator Function

The Calculator command adds, subtracts, multiplies, and divides values. To use it, hit the equals key. The routine displays the prompt START WITH <C>ELL VALUE X OR <Z>ERO?

Press the C key to use the current cell value as the starting subtotal. Press the Z key to start with a subtotal of zero.

Calculator displays the message SUBTOTAL = X, where X is the value you specified above, and the prompt ENTER VALUE: .

Type in a value and press the appropriate mathematical function (+, -, \*, or /). Calculator performs the function on the value to create a new subtotal, and displays it at the screen top.

With a starting subtotal of zero, typing 1, 2, 3, and a plus sign adds 123 to zero for a new subtotal of 123 (the program ignores instructions to divide by zero).

When you're finished, hit the equals key to set the cell value to the new subtotal, or hit the clear key to exit the routine.

To use the rapid-entry mode with the Calculator routine, press any arrow key instead of the equals key. This places the value of the subtotal in the cell, but does not update the rest of the worksheet.

## The Final Analysis

While NovaCalc is a full-featured spreadsheet, it lacks the speed of commercial programs. Occasionally, NovaCalc must do a dynamic string allocation. When this happens, the computer goes through memory to clean out the old variables and appears to hang up for several minutes.

However, this is a minor inconvenience when weighed against the cost of commercial spreadsheet programs. If it means saving \$100 or more, most home applications can probably wait a few minutes for the same results. ■

Mathematical Operator	Definition
A	Averages a series of cells in the same column or row
T	Totals a series of cells in the same column or row
+	Adds second entry to first entry
-	Subtracts second entry from first entry
*	Multiplies first entry by second entry
/	Divides first entry by second entry

Table 2. Mathematical operators for NovaCalc.

### Program Listing. NovaCalc spreadsheet program.

```
10 CLS:CLEAR150:AS=STRINGS(120,179):PRINT@0,AS::PRINT@267,"NovaC
  alc Financial Package Spreadsheet 1.0";:PRINT@896,"Copyright 198
  3 by Daniel D. Garms";:FORD=1TO1500:NEXT:CLEAR10000:N$=STRINGS(6
  4,32)
20 PRINT@096,"Set decimal precision to how many points? (1, 2, 3
  , or 4) ";
30 IS=INKEYS:IFI$="T"THEN30ELSEIFI$="I"ORIFI$="4"THEN30
40 N=VAL(I$):PRINTN::TS=STRINGS(N,48):I$="1":TS=IS+TS:N=VAL(TS)
50 PRINT@395,"Format spreadsheet as"::PRINT:PRINT,"1. 24 column
  s by 26 rows":PRINT,"2. 16 columns by 39 rows":PRINT,"3. 12 co
  lumnns by 52 rows":PRINT,"4. 8 columns by 78 rows"
60 IS=INKEYS:IFI$="T"THEN60ELSEIFI$="I"ORIFI$="4"THEN60
70 IFI$="1"THENH=24ELSEIFI$="2"THENH=16ELSEIFI$="3"THENH=12ELSEH
  =0
80 U=624/N:DIMBS(U,N):DIMDS(U,H):AS="FILE T":CLS
90 REMSCREENSETUP
100 B=197:I=1:J=1:K=1:L=1:E=0
110 CLS
120 C=J:R=I:PRINT@0,N$;NS;STRINGS(4,143);CHR$(191);STRINGS(6,143
  );";CHR$(J+64);";";STRINGS(11,143);";";CHR$(J+65);";";STRINGS(
  11,143);";";CHR$(J+66);";";STRINGS(11,143);";";CHR$(J+67);";";ST
  RINGS(6,143);CHR$(191);CHR$(32);
130 RS=STRS(R):RS=RIGHTS(R$,2):IFR>9THEN150
140 RS=RIGHTS(R$,1):TS="0":RS=TS+RS
150 PRINTCHR$(32);RS;CHR$(32);CHR$(191);STRINGS(57,32);CHR$(191)
;
160 R=R+1:IFR=I+13THEN100
170 PRINTCHR$(32)::GOTO130
180 REMPRINTCELLS
190 DNERRORGOTO2740:PRINT@0,NS::PRINT@0,"NovaCalc Spreadsheet ";
AS;" (Press </> for commands)";
200 PRINT@64,NS::PRINT@64,"* * * CALCULATING * * *":C=J:R=I:P=1
98
210 PRINT@P,CHR$(32)::VS=MIDS(B$(R,C),1,1):IFVS=>"A"ANDVS<CHR$(N
  +65)THEN290ELSEIFI$=>"0"ANDVS=<"9"THEN250ELSEIFI$=<"9"THEN230ELSE
  IFVS=<"0"THEN240ELSEIFI$="T"THEN220ELSEIFI$="("TREN270ELSE280
220 D$(R,C)=""::GOTO630
230 F#=0:TS=MIDS(B$(R,C),2):S#=VAL(TS):GOTO350
240 F#=0:TS=MIDS(B$(R,C),2):S#=VAL(TS):GOTO360
250 F=VAL(B$(R,C)):S=VAL(V$):IFF<STHEN280
260 F#=0:S#=VAL(B$(R,C)):GOTO350
```

Listing continued

Contact Daniel D. Garms at P.O. Box 3742, Reston, VA 22090.

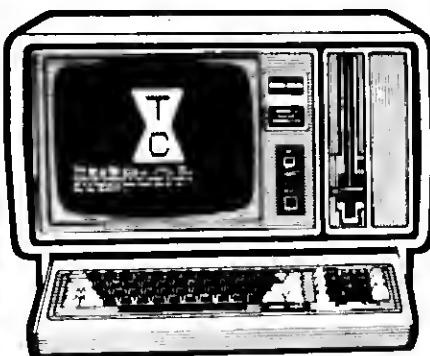
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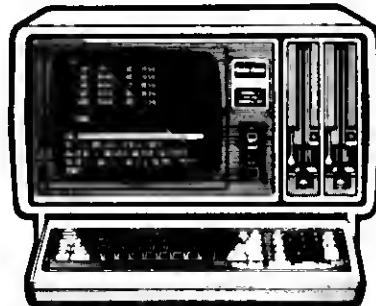
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Listing continued

```

270 D$(R,C)=MIDS(B$(R,C),4):GOTO630
280 D$(R,C)="ENTRY ERRDR ":GOTO630
290 T=LEN(B$(R,C)):IFT<4THEN280
300 W$=MIDS(B$(R,C),2,2):X$=MIDS(B$(R,C),4,1):V=ASC(V$)-64:W=VAL
(W$):IFV>HORW>UTHEN280ELSEIFV$=VAL(D$(W,V)):IFX$="C"THEN400
310 Y$=MIDS(B$(R,C),5,1):IFY$<"0">DLY$>"9">THEN330
320 T=VAL(Y$):Y$=MIDS(B$(R,C),5):S$=VAL(Y$):IFS4<TTHEN280ELSE340
330 Z$=MIDS(B$(R,C),6,2):Y=ASC(Y$)-64:Z=VAL(Z$):IFY>HCRZ>UTHEN280
0ELSEIFZ$=VAL(D$(Z,Y))
340 IFX$="+"THEN350ELSEIFX$="--"THEN360ELSEIFX$="*"THEN370ELSEIFX
$="/"THEN380ELSEIFX$="A"THEN410ELSEIFX$="T"THEN420ELSE280
350 T#=F#+S#:GOTO550
360 T#=F-S#:GOTO550
370 T#=F*S#:GOTO550
380 IFS=0TREN280
390 T#=F/S#:GOTO550
400 T#=F#:GOTO550
410 D=1
420 IFV=YTHEN490
430 F#=VAL(D$(W,V))
440 V=V+1:S#=VAL(D$(W,V))
450 T#=F+S#:D=D+1:IFV=YTHEN470
460 F#=T#:GOTO440
470 IFX$="T"THEN550
480 T#=T#/D:GOTO550
490 F#=VAL(D$(W,V))
500 W=W+1:S#=VAL(D$(W,V))
510 T#=F+S#:D=D+1:IFW=ZTHEN530
520 F#=T#:GOTO500
530 IFX$="T"THEN550
540 T#=T#/D
550 IFT$=>0THEN570
560 T#=T*B:T#=T-5:T#=FIX(T#):GOTO580
570 T#=T*B:T#=T+5:T#=FIX(T#):
580 QS=STR$(N):Q=LEN(Q$)-2:P$=".":T$=STR$(T#):F$=RIGHT$(T$,Q):F=
LEN(T$):IFF=<QTHENF=Q+1
590 T$=LEFT$(T$,F-Q):P=VAL(P$):F$=STR$(P):F$=MIDS(P$,2)
600 P=LEN(F$):IFF=<QTHEN620
610 S$=STRINGS(0-F,48):F$=S$+F$#
620 T$=T$+P$+F$:D$(R,C)=T$#
630 F=LEN(D$(R,C)):IFF>12THEN650
640 F=12-F:IFV$="("THEN670ELSE660
650 D$(R,C)=LEFT$(D$(R,C),12):F=0:PRINT@P," ";
660 PRINTSTRINGS(F,32):D$(R,C):GOTO600
670 PRINTD$(R,C):STRINGS(F,32):
680 R=R+1:IFR=I+13THEN700
690 P=P+64:GOTO210
700 R=I:P=P-754:C=C+1:IFC=J+4THEN710ELSE210
710 IFE=1TREN720ELSE730
720 I=I+13:D=D+1:GOTO1900
730 REMCURSORCONTROL
740 C=L:R=K:R$=STR$(R):R$=RIGHT$(R$,2):IFR>9THEN750ELSE
750 R$=RIGHT$(R$,1):T$="0":R$=T$+R$#
760 PRINT@B,CHR$(103)::PRINT@B+14,CHR$(107);
760 LS$=CHR$(C+64):T$=" =":LS$=LS$+R$+T$:PRINT@64,NS::PRINT@64,LS$;
D$(R,C);
770 I$=IBKEYS
780 IFI$=="THEN770ELSEIFI$=CHR$(13)THEN770ELSEIFI$=CHR$(34)TREN7
790 ELSEIFI$=CHR$(31)THEN190ELSEIFI$=CHR$(91)THEN790ELSEIFI$=CHR$(10)
790 THEN890ELSEIFI$=CHR$(0)THEN890ELSEIFI$=CHR$(9)THEN940ELSEIFI$=
"/"THEN990ELSE770
790 PRINT@B,CHR$(32)::PRINT@B+14,CHR$(32)::K=K-1:IFK<1THENK=1ELS
E810
800 PRINT@B,CHR$(103)::PRINT@B+14,CHR$(107)::GOTO770
810 IFK<1TREN830
820 B=B-64:GOTO740
830 I=I-1:GOTD120
840 PRINT@B,CHR$(32)::PRINT@B+14,CHR$(32)::K=K+1:IFK>UTHENK=K-1E
LSE860
850 PRINT@B,CHR$(103)::PRINT@B+14,CHR$(107)::GOTO770
860 IFK=I+13THEN880
870 B=B+64:GOTO740
880 I=I+1:GOTO120
890 PRINT@B,CHR$(32)::PRINT@B+14,CHR$(32)::L=L-1:IFL<1THEHL=1ELS
E910
900 PRINT@B,CHR$(103)::PRINT@B+14,CHR$(107)::GOTO770
910 IPL<JTHEN930
920 B=B-14:GOTO740
930 J=J-1:GOTD120
940 PRINT@B,CHR$(32)::PRINT@B+14,CHR$(32)::L=L+1:IFL>RTHENL=L-1E
LSE960
950 PRINT@B,CHR$(103)::PRINT@B+14,CHR$(107)::GOTO770
960 IPL=J+4THEN990

```

Listing continued

```

970 B=B+14:GOTO740
980 J=J+1:GOTO120
990 REMCOMMANDS
1000 PRINT#64,"Alpha Blank Copy Del Goto Help Load Print Quit Re
    pli Save Val =";
1010 I$=INKEY$:IFI$=""THEN1010ELSEIFI$=CHR$(31)THEN740ELSEIFI$=-
    "A"THEN1030ELSEIFI$="B"THEN1050ELSEIFI$="C"THEN1070ELSEIFI$="G"TH
    EN1470ELSEIFI$="H"THEN1600ELSEIFI$="L"THEN1670ELSEIFI$="P"THEN10
    50ELSEIFI$="Q"THEN2020ELSE1020
1020 IFI$="D"THEN1420ELSEIFI$="R"THEN2240ELSEIFI$="S"THEN2050ELS
    EIFI$="V"THEN2520ELSEIFI$=""THEN2580ELSE1010
1030 REMALPNA
1040 TS="" :PRINT#0,NS,NS,:PRINT#0,"Type entry then depress <E
    NTER>" :PRINT#64,LS,T$,:GOTO2540
1050 REMBLANK
1060 BS(R,C)="" :GOTO200
1070 REMCOPY
1080 PRINT#0,NS,NS,:PRINT#0,"Link cells? <Y>es or <N>o";
1090 I$=INKEY$:IFI$=""THEN1090ELSEIFI$=CHR$(31)THEN190ELSEIFI$=-
    "Y"THEN=0ELSEIFI$="N"THEN=2ELSE1090
1100 PRINT#0,STRINGS(128,32) :PRINT#0,"Copy <C>ell, <O>wn, or <
    R>ight?";
1110 I$=INKEY$:IFI$=""THEN1110ELSEIFI$="C"THEN1320ELSEIFI$="D"TH
    EN1120ELSEIFI$="R"THEN1220ELSEIFI$=CHR$(31)THEN190ELSE1110
1120 PRINT#64,"Type number of rows to copy down then <ENTER>" :
    T$="" :FS=LEFT$(L$,3):S$="C":FS=FS+S$:IFB$(R,C)=""THENFS="""
1130 I$=INKEY$:IFI$=""THEN1130ELSEIFI$=CHR$(31)THEN190ELSEIFI$=>
    "0"ANDI$=<"9"THEN1140ELSEIFI$=CHR$(13)THEN1150ELSE1130
1140 PRINT#0 :TS=TS+1:GOTO1130
1150 F=R+1:S=VAL(T$):T=R+S:IFT>UTHENT=U
1160 IFLEFTS(B$(R,C),1)="" THEN1170ELSE1160
1170 E=0:FOR=D:FTOT=B$(O,C)-BS(R,C):NEXT:GOTO190
1180 IFE=0THEN1210
1190 E=0:FS=VAL(D$(R,C)):FS=STR$(F#):IFF<0THEN1210
1200 FS=NIDS(F$,2)
1210 FORD=FTOT:B$(O,C)=FS:NEXT:GOTO190
1220 PRINT#0,4,"Type number of columns to copy right then <ENTER>
    " :T$="" :FS=LEFT$(L$,3):S$="C":FS=FS+S$:IFB$(R,C)=""TRENFS="""
1230 I$=INKEY$:IFI$=""THEN1230ELSEIFI$=CHR$(31)THEN190ELSEIFI$=>
    "0"ANDI$=<"9"THEN1240ELSEIFI$=CHR$(13)THEN1250ELSE1230
1240 PRINT#0 :TS=TS+1:GOTO1230
1250 F=C+1:S=VAL(T$):T=S+C:IFT>UTHENT=H
1260 IFLEFTS(B$(R,C),1)="" THEN1270ELSE1260
1270 E=0:FOR=D:FTOT=B$(R,D)-BS(R,C):NEXT:GOTO190
1280 IFE=0THEN1310
1290 E=0:FS=VAL(D$(R,C)):FS=STR$(F#):IFF<0THEN1310
1300 FS=NIDS(F$,2)
1310 FOR=D:FTOT:B$(R,O)=FS:NEXT:GOTO190
1320 SS=LEFT$(L$,3):FS="C":FS=BS+F$:PRINT#64,"Copy ",SS," to ":
    SS="""
1330 I$=INKEY$:IFI$=""THEN1330ELSEIFI$=CHR$(31)THEN190ELSEIFI$=<
    "A"ORI$>CHR$(N+64)THEN1330ELSE1330-I$"
1340 PRINT#0;
1350 I$=INKEY$:IFI$=""THEN1350ELSEIFI$=CHR$(31)THEN190ELSEIFI$=<
    "0"ORI$>"9"THEN1350
1360 PRINT#0 :SS=SS+I$:T=LEN(SS):IFT<2THEN1350
1370 F=ASC(T$)-64:S=VAL(SS)
1380 IFLEFTS(B$(R,C),1)="" THEN1410
1390 IFE=2THEN1410
1400 BS(S,F)=FS:GOTO190
1410 E=0:BS(S,F)=BS(R,C):GOTO190
1420 REMDELETE
1430 FS=LEFT$(B$(R,C),1):IFF$="" THEN190
1440 F#=VAL(D$(R,C)):FS=STR$(F#):IFF<0THEN1460
1450 FS=NIDS(F$,2)
1460 BS(R,C)=FS:GOTO190
1470 REMGOTO
1480 PRINT#0,NS,NS,:PRINT#0,"Go to which cell? ";
1490 I$=INKEY$:IFI$=""THEN1490ELSEIFI$=CHR$(31)THEN190ELSEIFI$=<
    "A"ORI$>CHR$(B+64)THEN1490ELSE1490-I$:SS="""
1500 PRINT#0;
1510 I$=INKEY$:IFI$=""THEN1510ELSEIFI$=CHR$(31)THEN190ELSEIFI$=<
    "0"ORI$>"9"THEN1510
1520 PRINT#0 :BS=SS+I$:T=LEN(SS):IFT<2THEN1510
1530 S=VAL(SS):IFT>UTHEN2740
1540 J=ASC(F$)-64:L=J:C=L:F=0:IFJ>R-3THEN1550ELSE1560
1550 J=H-3:F=N-L:F=F*14:F=42-F
1560 R=VAL(SS):IFR>UTHEN2740
1570 IFRU-12THEN1590
1580 I=R:K=R:B=197:B=B+F:GOTO120
1590 I=R/13+.95:I=FIX(I):I=I*13-12:T=(R-I)*64:B=T+197+F:K=R:GOTO
120
1600 REMHELP

```



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Listing continued

```

1610 CLS:PRINT" * * * HELP ON COMMANDS * * * :PRINT"<A>lpha allow
s cell to contain a non-numeric/formula value":PRINT"<B>lank cle
ars cell and deletes any formula used to create it":PRINT"<C>copy
makes cell equal to value of a specified cell"
1620 PRINT"<D>el(ete) formula used to calculate cell but retain
value"
1630 PRINT"<G>oto positions cell pointer (cursor) at specified c
ell":PRINT"<L>oads a previously saved file (designated files 1 t
hru 9)":PRINT"<P>rints a copy of all rows of displayed columns"
1640 PRINT"<Q>uit ends session giving option to save data to one
of 9 files<R>epli(cate) projects/modifies a formula over a seri
es of cells<S>aves data to one of 9 files":PRINT"<V>al(ue) estab
lishes contents of a cell through keyboard input"
1650 PRINT"<CLEAR> cancels command/action and returns to spreads
heet":PRINT"<*> Accesses built-in five function calculator":PRIN
T:PRINT" * * * DEPRESS <CLEAR> TO RETURN TO WORKSHEET * * *
";
1660 I$=INKEY$: IF I$="" THEN 1660 ELSE IF I$=CHR$(31) THEN 110 ELSE 1660
1670 REMLOAD
1680 PRINT#0,NS;NS:PRINT#0,"LOAD WHICH FILE? (1-9) ";
1690 I$=INKEY$: IF I$="" THEN 1690 ELSE IF I$=CHR$(31) THEN 190 ELSE IF I$<
"0">I$>"9" THEN 1690
1700 C=1:R=1:A$=LEFT$(A$,5):A$=A$+I$
1710 PRINT#64,"LOADING ";A$;" -- PLEASE WAIT";:IF I$="1" THEN 1720 E
LSE IF I$="2" THEN 1730 ELSE IF I$="3" THEN 1740 ELSE IF I$="4" THEN 1750 ELSE I
F I$="5" THEN 1760 ELSE IF I$="6" THEN 1770 ELSE IF I$="7" THEN 1780 ELSE IF I$=
"8" THEN 1790 ELSE IF I$="9" THEN 1800
1720 CLOSE:OPEN "I",2,"FILE1":GOTO1010
1730 CLOSE:OPEN "I",2,"FILE2":GOTO1010
1740 CLOSE:OPEN "I",2,"FILE3":GOTO1010
1750 CLOSE:OPEN "I",2,"FILE4":GOTO1010
1760 CLOSE:OPEN "I",2,"FILE5":GOTO1010
1770 CLOSE:OPEN "I",2,"FILE6":GOTO1010
1780 CLOSE:OPEN "I",2,"FILE7":GOTO1010
1790 CLOSE:OPEN "I",2,"FILE8":GOTO1010
1800 CLOSE:OPEN "I",2,"FILE9":GOTO1010
1810 INPUT#2,B$(R,C)
1820 C=C+1:IF C=<RTHEN1010
1830 C=1:R=R+1:IF R=<UTHEN1010
1840 CLOSE:GOTO1010
1850 REMPRINT
1860 PRINT#0,NS;NS:PRINT#0,"READY PRINTER -- Press <ENTER> or <
CLEAR> to cancel";
1870 I$=INKEY$: IF I$="" THEN 1870 ELSE IF I$=CHR$(31) THEN 190 ELSE IF I$=C
HR$(13) THEN 1800 ELSE 1870
1880 PRINT#64,"Print <D>isplayed values or <F>ormulas?";:I$=INKE
Y$: IF I$="" THEN 1880 ELSE IF I$="D" THEN 1890 ELSE IF I$="F" THEN 1920 ELSE IF
I$=CHR$(31) THEN 1900 ELSE 1880
1890 D=1:G=0/13:M=1:I=1:E=1
1900 IF D>GTHEN1910ELSEP120
1910 E=0:I=M
1920 PRINT#64,NS;:PRINT#64,"PRINTING -- PLEASE WAIT";
1930 S$=%
  "R=1:C=J:LPRINT$trings(10,35);";CHR$(C+64);
  " ;$trings(12,35);";CHR$(C+65);";$trings(12,35);";CHR$(C+66);
  " ;$trings(12,35);";CHR$(C+67);";$trings(7,35)
1940 RS=STR$ (R):T=LEN(R$):T=3-T
1950 LPRINT$trings(T,32);R$;" * ";
1960 IF I$="D" THEN 1900
1970 LPRINT$tingss;B$(R,C);:LPRINT" * ";:GOTO1990
1980 LPRINT$tingss;D$(R,C);:LPRINT" * ";
1990 C=C+1:IF C=<J+4THEN1960
2000 LPRINT:R=R+1:C=J:IF R=<UTHEN1940
2010 LPRINT$trings(65,35):R=K:C=L:GOTO120
2020 REMQUIT
2030 PRINT#0,NS;NS:PRINT#0,"SAVE CONTENTS -- Depress <Y>es to s
ave or <N>o";
2040 I$=INKEY$: IF I$="" THEN 2040 ELSE IF I$=CHR$(31) THEN 190 ELSE IF I$=
"Y" THEN 2050 ELSE IF I$="N" THEN 2230 ELSE 2040
2050 PRINT#0,NS;NS:PRINT#0,"Save as which file? (1-9) ";
2060 I$=INKEY$: IF I$="" THEN 2060 ELSE IF I$=CHR$(31) THEN 190 ELSE IF I$>
"0" AND I$<"9" THEN 2070 ELSE 2060
2070 C=1:R=1:A$=LEFT$(A$,5):A$=A$+I$
2080 PRINT#64,"SAVING AS ";A$;" -- PLEASE WAIT";:IF I$="1" THEN 2090 E
LSE IF I$="2" THEN 2100 ELSE IF I$="3" THEN 2110 ELSE IF I$="4" THEN 2120 E
LSE IF I$="5" THEN 2130 ELSE IF I$="6" THEN 2140 ELSE IF I$="7" THEN 2150 ELSE IF
I$="8" THEN 2160 ELSE IF I$="9" THEN 2170
2090 CLOSE:OPEN "O",1,"FILE1":GOTO2100
2100 CLOSE:OPEN "O",1,"FILE2":GOTO2100
2110 CLOSE:OPEN "O",1,"FILE3":GOTO2100
2120 CLOSE:OPEN "O",1,"FILE4":GOTO2100
2130 CLOSE:OPEN "O",1,"FILE5":GOTO2100
2140 CLOSE:OPEN "O",1,"FILE6":GOTO2100
2150 CLOSE:OPEN "O",1,"FILE7":GOTO2100

```

Listing continued

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```

2160 CLOSE:OPEN"D",1,"FILE8":GOTO2180
2170 CLOSE:OPEN"O",1,"FILE9"
2180 PRINT#1,CHR$(34);BS(R,C);CHR$(34);
2190 C=C+1:IFC=<BTHEN2180
2200 C=1:R=R+1:IFR=<UTHEN2180
2210 PRINT#64,"<R>turn to spreadsheet or <N>ew spreadsheet or <E>xit program?";
2220 I$=INKEY$:IFI$=="THEN2220ELSEIFI$="R"THEN190ELSEIFI$="N"THE
N10ELSEIFI$="E"THEN2230ELSE2220
2230 CLOSE:CMD"T":CLS:END
2240 REMREPLICATE
2250 VS=LEFT$(BS(R,C),1):IFV$<"A">ORV$>CHR$(U+64)THEN2740
2260 PRINT#0,NS;NS$;:PRINT#0,"Replicate formula <D>own or <R>ight
? ";
2270 I$=INKEY$:IFI$=="THEN2270ELSEIFI$=CHR$(31)THEN190ELSEIFI$="D"THEN2280ELSEIFI$="R"THEN2420ELSE2270
2280 PRINTI$;:PRINT#64,"Type number of rows to replicate down th
en <ENTER> ";:T$= ""
2290 I$=INKEY$:IFI$=="THEN2290ELSEIFI$=CHR$(31)THEN190ELSEIFI$=C
HRS(13)THEN2310ELSEIFI$="0"ANDI$=<"9"THEN2300ELSE2290
2300 PRINTI$;:T$=T$+I$;GOTO2290
2310 S$="0":F=R:S=VAL(T$):S=S+R:IF S>UTHENS=U
2320 VS=LEFT$(BS(F,C),1):WS=MIDS(B$(F,C),2,2):W=VAL(W$):X$=MIDS(
B$(F,C),4,1):W=W+1:IF W>UTHEN2740
2330 NS=STR$(W):IF W>9THEN2350
2340 WS=RIGHT$(W$,1):W$=S$+WS
2350 WS=RIGHT$(W$,2):F$=S$+WS+X$:Y$=MIDS(B$(F,C),5,1):IFY$=>"A" A
NDYS<CHR$(U+65)THEN2370ELSEIFI$="THEN2410
2360 Y$=MIDS(B$(F,C),5):F$=F$+Y$:GOTO2410
2370 Z$=MIDS(B$(F,C),6,2):Z=VAL(Z$):Z=Z+1:IF Z>UTHEN2740
2380 Z$=STR$(Z):IF Z>9THEN2400
2390 Z$=RIGHT$(Z$,1):Z$=S$+Z$
2400 Z$=RIGHT$(Z$,2):F$=F$+Y$+Z$
2410 F=F+1:BS(F,C)=F$:IFF=STHEN190ELSE2320
2420 PRINTI$;:PRINT#64,"Type number of columns to replicate righ
t then <ENTER> ";:T$= ""
2430 I$=INKEY$:IFI$=="THEN2430ELSEIFI$=CHR$(31)THEN190ELSEIFI$=C
HRS(13)THEN2450ELSEIFI$="0"ANDI$=<"9"THEN2440ELSE2430
2440 PRINTI$;:T$=T$+I$;GOTO2430
2450 S$="0":F=C:S=VAL(T$):S=S+C:I$=RTHENS=H
2460 VS=LEFT$(BS(R,F),1):V=ASC(V$)+1:W$=MIDS(B$(R,F),2,2):X$=MID
S(B$(R,F),4,1):IF V=64GOTO2740
2470 F$=CHR$(V$):F$=F$+S$+X$:Y$=MIDS(B$(R,F),5,1):IFY$=>"A" ANDY$=
<CHR$(H+65)THEN2490ELSEIFI$="THEN2510
2480 Y$=MIDS(B$(R,F),5):F$=F$+Y$:GOTO2510
2490 Z$=MIDS(B$(R,F),6,2):Y=ASC(Y$)+1:IFY=64>RTHEN2740
2500 Y$=CHR$(Y$):F$=F$+Y$+Z$
2510 F=F+1:BS(R,F)=F$:IFF=STHEN190ELSE2460
2520 REMVALUE
2530 PRINT#0,NS;NS$;:PRINT#0,"Type value or formula then depress
<ENTER>";:PRINT#64,L$;T$= ""
2540 I$=INKEY$:IFI$=="THEN2540ELSEIFI$=CHR$(13)THEN2560ELSEIFI$=
CHR$(31)THEN190ELSEIFI$=CHR$(34)THEN2540ELSEIFI$=CHR$(91)DRIS$>CH
RS(7)ANDI$<CHR$(11)THEN2730
2550 TS=TS+I$;PRINTI$;:GOTD2540
2560 BS(R,C)=TS:GOTO190
2570 REN(=)CALCULATOR
2580 T#=VAL(B$(R,C)):PRINT#0,NS;NS$;:PRINT#0,"Start with <C>ell v
alue "<T$> or <Z>ero?"
2590 I$=INKEY$:IFI$=="THEN2590ELSEIFI$="C"THEN2620ELSEIFI$="2"TH
EN2620ELSEIFI$=CHR$(31)THEN190ELSE2590
2600 T#=0:F#=0
2610 F$= ""
2620 PRINT#0,NS;NS$;:PRINT#0,"SUBTOTAL = "<T$>:PRINT#64,"ENTER VA
LUE: ";
2630 I$=INKEY$:IFI$=="THEN2630ELSEIFI$=CHR$(31)THEN190ELSEIFI$=>
"0"ANDI$=<"9"THEN2640ELSEIFI$="+"THEN2650ELSEIFI$="-"THEN2660ELS
EIFI$="+"THEN2670ELSEIFI$="/"THEN2680ELSEIFI$="+"THEN2700ELSE263
0
2640 PRINTI$;:F$=F$+I$;GOTO2630
2650 F#=VAL(F$):T#=T#+F#:GOTO2610
2660 F#=VAL(F$):T#=T#-F#:GOTO2610
2670 F#=VAL(F$):T#=T#*F#:GOTO2610
2680 F#=VAL(F$):IFF#=0THEN2630
2690 T#=T#/F#:GOTO2610
2700 IPT#<0THEN2720
2710 FS=STR$(T$):BS(R,C)=MIDS(F$,2):GOTO190
2720 BS(R,C)=STR$(T$):GOTO190
2730 BS(R,C)=T$:PRINT#0,"RAPID ENTRY (Press </> for commands <CL
EAR> updates)"::PRINT#B+1,STRINGS(13,32):PRINT#B+2,LEFT$(BS(R,C
),12):GOTO780
2740 PRINT#64,NS$;:PRINT#64,"* * * ENTRY ERROR * * *":FORD=1TO15
00:NEXT:GOTO190

```



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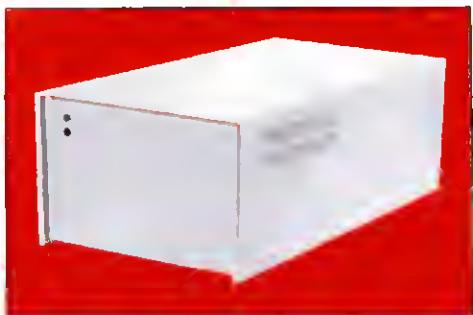
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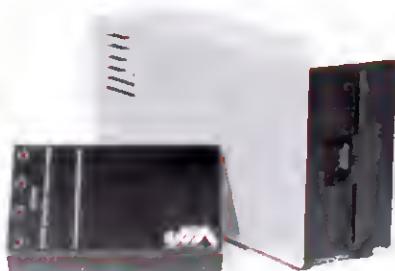
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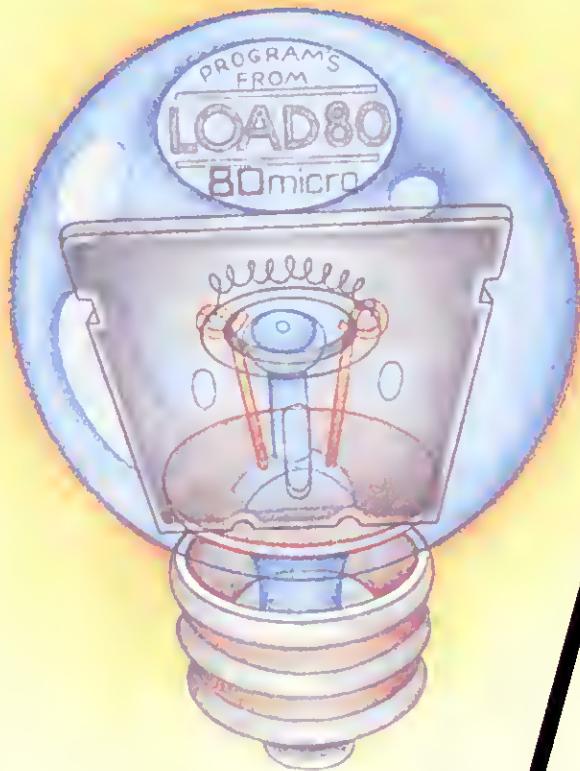
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## Basic Concepts

Program Listing 1 prints out worksheets that let you design and map graphics characters of varying sizes (see Fig. 1). First type in, save, and run Listing 1. Once you start experimenting with your own graphics, you'll need a lot of these worksheets.

The seven numbers (1, 2, 4, 8, 16, 32, and 64) in the worksheet's left-hand column represent the seven controllable print-head wires that, when activated in a specific pattern, create a variety of graphics characters. The print-head pins are numbered this way so that you get a unique sum, in the range of 1-127, for any combination of pins. For example, while the sum of all seven numbers is 127, every combination of the numbers yields a different sum.

The following program prints each of the available TRS-80 graphics characters in a line without gaps. Because of this, you can develop custom graphics characters, made up of individual standard graphics characters, of any length. The CHR\$(30) in line 50 of the program below resets the printer, removing it from the graphics mode. Now, type in and run this program:

```
10 LPRINT CHR$(18) 'set printer to graphics
 mode
20 FOR I = 128 TO 255
30 LPRINT CHR$(I);
40 NEXT I
50 LPRINT CHR$(30) 'set printer to non-graph-
 ics mode
```

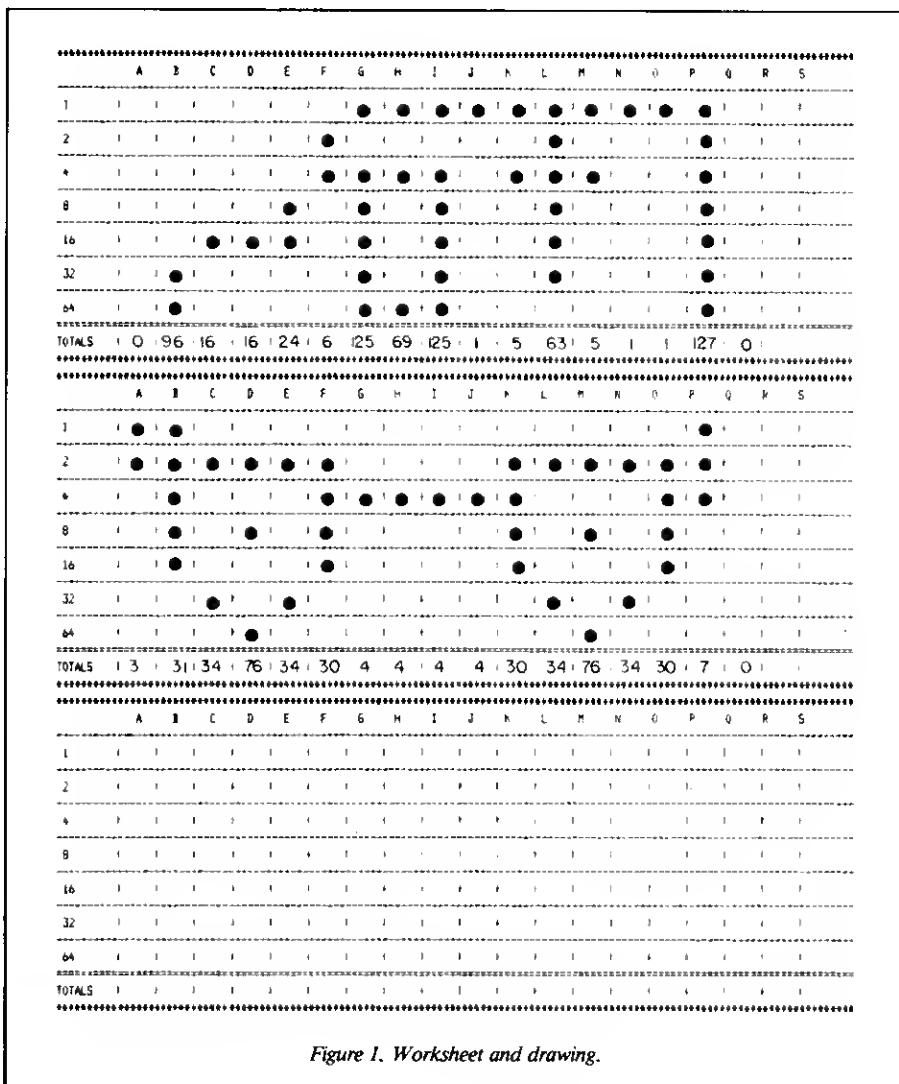


Figure 1. Worksheet and drawing.

## Custom Printing

The graphics characters printed here probably look familiar, especially if you've ever shopped for a printer. Be more creative now and try your skill at customized graphics.

Using a soft lead pencil, put dots in each box of column A of the worksheet you created with Program Listing 1. In

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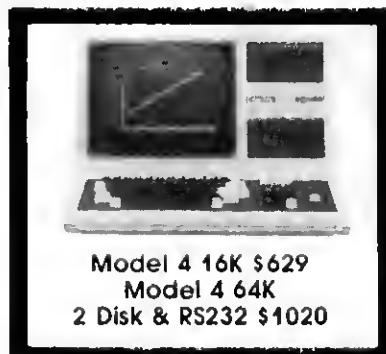
# PLUS after PLUS after PLUS



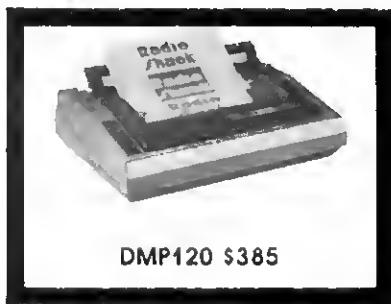
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Figure 2. Printout of drawing in Figure 1.

*Program Listing 1. Basic program to create worksheets.*

```

100 ' GRAPH PAPER FOR CNARGEN/GSL AND GS2
110 ' SAVED AT GRAPAPER/PRM
120 CLEAR1000
130 LPRINTCERS(27);CNRS(20)'set to condensed mode
140 CLS
145 PRINT"SET PAPER IN PRINTER AT TOP OF NEW SHEET"
147 PRINT:PRINT" HIT ANY KEY TO START PRINTING"
150 IF INKEY$="" THEN 150
160 FOR FS=1TO3 ' loop to set number of forms
170 LPRINTSTRINGS(130,"*")
175 GOSUH1000
180 B=0
190 FOR I=1TO8
200 LPRINT" "
210 IF I<8TENGOSUB290 ELSE GOSUH448
220 GOSUB390 'subroutine to put in pin numbers
230 GOSUH310 'lprint column seperating bar
240 NEXTI
250 LPRINT" "
260 LPRINTSTRINGS(130,"*")
270 NEXT FS
280 END
290 LPRINTSTRINGS(130,"-")
300 RETURN
310 FOR I3=1TO19
320 LPRINTTAB(10);
330 LPRINTCNRS(10); 'go into graphics mode
340 LPRINTCNRS(191); 'lprint graphic bar
350 LPRINTCNRS(30); 'come out of graphics mode
360 LPRINT" "; ' six blank spaces
370 NEXTI3
380 RETURN
390 'SUBROUTINE TO PUT IN NUMBERS
400 A=2[B
410 B=B+1
420 IF A>64 THEN LPRINT"TOTALS";:ELSE LPRINTA;
430 RETURN
440 'SUBROUTINE TO PRINT TOTAL LINE
450 LPRINTSTRINGS(130,"*")
460 RETURN
1000 CL=65
1005 LPRINTTAB(13);
1010 LPRINTCHR$(CL);
1015 LPRINT" ";
1020 IF CL=63 THEN 1050
1030 CL=CL+1
1040 GOTO1010
1050 RETURN

```

columns B-F put a dot in the top and bottom row only (pin numbers 1 and 64). In column G, put dots from top to bottom again. Now add the values of each column: 127 for A, 65 for B, 65 for C, 65 for D, 65 for E, 65 for F, and 127 for G.

When you run Program Listing 2, it prompts you to type in the totals for each column. After you enter the numbers, type in 999 to terminate data entry. Your printer should be on, and it will print the following: a tiny box, the pin firing codes (the column values), and a three-line series of the character in different font sizes (elongated, normal, and condensed).

Notice that all the boxes are connected; to print a series of individual boxes, enter a zero before typing in 999. Keep in mind that the program automatically adds 128 to the pin codes because the printer requires that all character codes be in a range of 128 to 255.

Try experimenting with different drawings or simply enter a series of numbers; for example, entering 10 numbers at intervals of 5 (don't forget to type 999) makes a nice line of graphics. This type of graphic can be used in a subroutine to separate reports, or as a more interesting alternative to asterisks.

## Larger Graphics

Single line graphics are nice, but somewhat limited. Program Listing 3, while operating on the same concept as Program Listing 2, lets you print graphics that are twice as high. When mapping out the larger characters, split the character between two worksheets and calculate column totals for each. After tabulating the totals, run Program Listing 3, which, in turn, prompts you to enter these values.

Remember to enter zeros in the blank columns to guarantee alignment. The drawing in Fig. 1 and the corresponding

*Program Listing 2. Basic program to enter one-line graphics.*

```
100 '*****
110 ' CBARGEN/GS1
120 '*****
130 CLS
140 PRINT"USE GRAPAPER/FRM PROGRAM TO PLOT A SEQUENCE OF PIN FIRINGS"
150 PRINT"THEN ENTER THE TOTAL OF EACH COLUMN IN RESPONSE TO THE P
RONPTS."
160 PRINT:PRINT"THE PROGRAM WILL ADD 128 TO EACH TOTAL TO GENERATE
PRINTER"
```

*Listing 2 continued*



Figure 3. Graphics lines created by Program Listings 4 (top line), 5 and 6 (middle line), and 7 (bottom line).

*You can expand  
this technique  
to print graphics  
for all purposes.*

printout in Fig. 2 are examples of this size character. (The subroutine in Program Listing 7 is also geared towards the larger graphics characters.)

The subroutines in Program Listings 4-7 illustrate the variety of ways to store and print graphics codes. Program Listing 4, for example, uses CHR\$ code links stored in strings to print a line of graphics characters. I used A\$ and A1\$ only because I didn't want to print off the page when listing the program. Your strings can be much longer if you choose.

Because this particular character is good only when printed in a line, I used a For...Next loop to fill the page from left to right. The string method used here is quite fast, especially when compared with the subroutines in Program Listings 5 and 6.

Program Listings 5 and 6 both use Read Data statements. While one is quicker than the other, they're both slow. I've included these because it's easier to change data statements in each graphics subroutine than to retype the CHR\$ codes. If time isn't critical, this method makes it easy to build a library of subroutines.

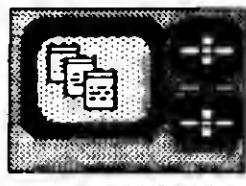
You can easily expand the technique discussed here to print graphics of all sizes for all purposes. Playing with combinations of column values is both fun and productive. Happy printing! ■

*Write to Glen E. Sparks at 6186  
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*Listing 2 continued*

```
170 PRINT"GRAPHICS IN A LINE USING EACH TO THE FONTS AVAILABLE TO
GRAPHICS"
180 PRINT"IT WILL ALSO PRINT OUT THE COLUMN TOTALS FOR REFERENCE."
185 PRINT:PRINT"TYPE 999 TO END INPUT"
190 PRINT:PRINT"Hit ANY KEY TO BEGIN"
200 PRINT:PRINT:PRINT
210 IF INKEY$=""THEN210
220 CLS
230 CLEAR500
240 DINN(50)
250 Z=1
260 '*****
270 ' INPUT CODES
280 '*****
290 CLS
300 I=1
305 CL=65
310 PRINT"PIN COLUMN ";CHR$(CL);"
315 INPUT N(I)
320 IFN(I)=999 THEN 370
330 IFN(I)>127 THENPRINT"TOO HIGH-MUST BE UNDER 127":GOTO310
350 I=I+1
355 CL=CL+1
360 GOTO310
370 '*****
380 ' SEND TO PRINTER
390 '*****
400 T=I
410 FORI=1TOT
415 IFN(I)=999 THEN N(I)=0
420 A$=CHR$(N(I)+120)
430 LPRINT CNRS(10);A$; ' put into graphics mode and lprint CHR$
440 NEXTI
450 LPRINTCNRS(30) 'set to non-graphic text
460 LPRINTCRR$(27);CHR$(20) 'set to condensed for code number print
out
470 Pori=1TO(T-1):LPRINTN(I);:LPRINT" ";
480 NEXTI
490 '*****
500 ' SEND LINE OF CUSTOM CHARACTERS TO PRINTER
510 ' SET CHARACTER FONT FOR LINE OF CUST. CHAR
520 '*****
560 CLS
570 IFZ>1THENLPRINTCRR$(27);CRR$(15) 'get out of Expanded mode
580 ONZ GOTO 590 ,610 ,630 ,650
590 LPRINT CRR$(27);CNRS(14) 'expanded mode
600 GOTO670
610 LPRINTCRR$(27);CRR$(19) 'normal characters
620 GOTO670
630 LPRINTCRR$(27);CHR$(20) 'condensed mode
640 GOTO670
650 RUN240
660 '*****
670 ' PRINTOUT OF CHAR REPEATED 20 TIMES
671 '*****
680 FORI1=1TO20
690 FORI=1TO(T-1)
700 A$=CHR$(N(I)+120) 'add 120 to pin number to produce CHR$ code
710 LPRINTCHR$(10);A$; 'go into graphics mode and print char
720 NEXTI:NEXTI1
730 LPRINTCHR$(30) 'get out of graphics mode
740 Z=Z+1
750 GOTO 570
```

*End*



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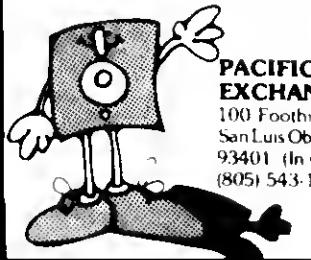
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*Program Listing 3. Basic program to enter two-line graphics.*

```

100 '*****
110 ' CHARGEN/GS2
120 '*****
130 CLS
140 PRINT"USE GRAPAPER/FRM PROGRAM TO PLOT A SEQUENCE OF PIN FIRINGS"
150 PRINT"THEN ENTER THE TOTAL OF EACH COLUMN IN RESPONSE TO THE PROMPTS."
155 PRINT"TYPE 999 TO TERMINATE DATA INPUT"
160 PRINT:PRINT"THE PROGRAM WILL ADD 128 TO EACH TOTAL TO GENERATE PRINTER"
170 PRINT"GRAPHICS IN A LINE USING EACH TO THE FONTS AVAILABLE TO GRAPHICS"
180 PRINT"IT WILL ALSO PRINT OUT THE COLUMN TOTALS FOR REFERENCE."
190 PRINT:PRINT"Hit ANY KEY TO BEGIN"
200 PRINT:PRINT:PRINT
210 IF INKEY$="" THEN 210
220 CLS
230 CLEAR500
240 DIMN(50)
241 DIMNL(50)
250 Z=1
260 '*****
270 ' INPUT CODES
280 '*****
290 CLS
300 I=1
305 CL=65
310 PRINT"PIN COLUMN ";CNRS(CL);" "
315 INPUT N(I)
320 IFN(I)=999 THEN 370
330 IFN(I)>127 PRINT"TOO HIGH-MUST BE UNDER 127":GOTO310
331 INPUT"BOTTOM HALF ";NL(I)
332 IFNL(I)>127 THEN PRINT"TOO HIGH-MUST BE UNDER 127":GOTO331
350 I=I+1
355 CL=CL+1
360 GOTO310
370 '*****
380 ' SEND TO PRINTER
390 '*****
400 T=1
410 FORI=1TOT
415 IFN(I)=999 THEN N(I)=0
420 A$=CHR$(N(I)+128)
430 LPRINT CHR$(10);A$; ' put into graphics mode and lprint CHR$
440 NEXTI
441 LPRINT"
442 FORI=1TOT
443 B$=CHR$(NL(I)+128)
444 LPRINTCHR$(10);B$;
445 NEXTI
450 LPRINTCHR$(30) 'set to non-graphic text
460 LPRINTCHR$(27);CNRS(20) 'set to condensed for code number printout
465 LPRINT"TOP "
470 FORI=1TO(T-1):LPRINTN(I);:LPRINT" ";
480 NEXTI
481 LPRINT"
482 LPRINT"BOTTOM "
485 FORI=1TO(T-1):LPRINTNL(I);:LPRINT" ";:NEXTI
490 '*****
500 ' SEND LINE OF CUSTOM CHARACTERS TO PRINTER
510 ' SET CHARACTER FONT FOR LINE OF CUST. CHAR
540 '*****
560 CLS
570 IFZ>1 THEN LPRINTCHR$(27);CHR$(15) 'get out of Expanded mode
580 ONZ GOTO 590 ,610 ,630 ,650
590 LPRINT CHR$(27);CHR$(14) 'expanded mode
600 GOTO670
610 LPRINTCHR$(27);CNRS(19) 'normal characters
620 GOTO670
630 LPRINTCHR$(27);CHR$(20) 'condensed mode
640 GOTO670
650 RUN240
669 '*****
670 ' PRINTOUT OF CHAR REPEATED 20 TIMES
671 '*****
680 FORI=1TO20
690 FORI=1TO(T-1)
700 A$=CHR$(N(I)+128) 'add 128 to pin number to produce CNRS code
710 LPRINTCHR$(18);A$; 'go into graphics mode and print char
720 NEXTI:NEXTI1
721 LPRINT"
722 FORI=1TO20
723 FORI=1TO(T-1)
724 B$=CHR$(NL(I)+128)
725 LPRINTCHR$(10);B$;
726 NEXTI:NEXTI1

```

*Listing 3 continued*

*Listing 3 continued*

```
727 LPRINT**  
730 LPRINTCHR$(30) 'get out of graphics mode  
740 Z=Z+1  
750 GOTO 570
```

*End*

*Program Listing 4. Subroutine using string method.*

```
2000 'STRINGS/GS3  
2010 '2 seconds to load buffer and printout line  
2020 'add 128 to each pin column total  
2030 AS=CHR$(129)+CHR$(131)+CHR$(159)+CHR$(191)+CHR$(254)+CHR$(252)  
2040 AI$=CHR$(248)+CHR$(224)+CHR$(228)+CHR$(194)+CAR$(161)+CHR$(15  
3)+CHR$(133)+CHR$(131)  
2050 LPRINTCHR$(27);CHR$(14) 'set printer to expanded mode  
2060 LPRINTCHR$(10) 'set to graphics mode  
2070 FORI=1TO17  
2080 LPRINTA$+AI$;  
2090 NEXTI  
2100 LPRINTCHR$(27);CHR$(15) 'reset printer out of expanded mode  
2110 LPRINTCHR$(30) 'reset printer to non-graphics mode  
2120 RETURN
```

*End*

*Program Listing 5. Subroutine that prints graphics line.*

```
3000 'SUBGRAF/GS4  
3010 'Subroutine to print graphic line (rolling ribbon graphic)  
3020 '17 second delay to fill buffer and print  
3030 LPRINTCHR$(27);CAR$(20) 'set to condensed mode  
3040 LPRINTCHR$(10) ' set to graphics mode  
3050 FORI=1TO50  
3060 READN:IFN=999THEN3000  
3070 IFN>=0 THEN LPRINTCHR$(128+N);:GOTO3060  
3080 LPRINT;  
3090 RESTORE 'set to read data again  
3100 NEXTI  
3110 LPRINTCHR$(30) ' reset printer to non-graphics mode  
3120 DATA1,3,7,31,63,126,124,112,96,92,66,33,25,5,1,999  
3130 RETURN
```

*End*

*Program Listing 6. Subroutine that prints graphics line.*

```
3000 'SUBGRAF/GS5  
3005 DIMM(20)  
3010 'Subroutine to print graphic line (rolling ribbon graphic)  
3020 'ONLY 9 second delay to fill buffer and print  
3030 LPRINTCHR$(27);CHR$(20) 'set to condensed mode  
3040 LPRINTCHR$(10) ' set to graphics mode  
3050 I=1  
3060 READN:M(I)=N:IFN>255THEN3005  
3080 I=I+1:GOTO3060  
3005 T=I:FORJ=1TO50  
3090 FORI=1TO(T-1):LPRINTCNA$(M(I)+I28);:NEXT  
3100 NEXTJ  
3110 LPRINTCHR$(30) ' reset printer to non-graphics mode  
3120 DATA1,3,7,31,63,126,124,112,96,92,66,33,25,5,1,999  
3130 RETURN
```

*End*

*Program Listing 7. Subroutine that prints two-line characters.*

```
3000 'SUBGRAF/GS6 double high graphic  
3010 DIMM(20),M1(20)  
3020 LPRINTCHR$(27);CHR$(14) 'set printer to expanded mode  
3030 LPRINTCHR$(10) 'set printer to graphic mode  
3040 ' Read and printout top portion graphic  
3050 I=1  
3060 READN:M(I)=N:IFN>255THEN3000  
3070 I=I+1:GOTO3060  
3080 T=I:FORJ=1TO20  
3090 FORI=1TO(T-1):LPRINTCHR$(M(I)+I28);:NEXT  
3100 NEXTJ  
3110 ' Read and printout bottom portion graphic  
3120 I=1:LPRINT  
3130 READN1:M1(I)=N1:IFN1>255THEN3150  
3140 I=I+1:GOTO3130  
3150 T=I:FORJ=1TO20  
3160 PRINT:FORI=1TO(T-1):LPRINTCHR$(M1(I)+I28);:NEXT  
3170 NEXTJ  
3180 LPRINTCHR$(30) 'reset printer to non-graphics mode  
3190 LPRINTCHR$(27);CHR$(15) 'reset printer out of expanded mode  
3200 DATA 0,0,126,1,125,5,5,5,5,5,5,125,1,126,0,0,0,0,999  
3210 DATA 0,126,65,85,73,85,73,85,73,85,72,65,126,0,0,0,999  
3220 RETURN
```

*End*



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# ON THE RECORD

Sequential random-access files each have their own advantages and disadvantages for data storage and retrieval. Here's a way to combine the best features of both.

Sequential files use disk space efficiently, but they have their disadvantages. To update records, a program must read and write an entire file. And searching for a specific record can require extensive disk input/output or main memory, depending on the technique you use. Random-access files (also called direct-access files) don't have these drawbacks and, with good planning, they can be reasonably efficient users of disk space.

I'll introduce three Model I/III Basic programs that create and sort indexed random-access files, letting you easily manipulate data stored on disk. First, however, I'll describe how random-access files work.

## Records and Subrecords

Table 1 shows the Disk Basic commands you use to create and access random files. Random-access files store data in buffers. A buffer is one 255-character record; you can define subrecords (i.e., fields) within the buffer using the Field command. The Get command accesses the full record; you need a file-handling program to access the subrecords.

For example, assume you want a file of names and phone numbers that sets aside 25 characters for a name and 12 characters for a phone number. Positions 1-25 in the file buffer contain name characters and positions 26-37 contain the phone number. Each 255-character main record could hold

six of these 37-character subrecords, with 33 unused characters left over.

Here's how you'd open this file and define its fields:

```
10 OPEN 1, "R", "NAMEPHON/RND:1"
20 FOR 1% = 0 TO 5
30 FIELD 1,(1%*37) AS DMS, 25 AS NMS(1%),
12 AS PHS(1%)
40 NEXT 1%
```

Line 10 opens the file as a random file. If the file already exists, the system finds it. If it doesn't, the system creates it. Line 20 determines that the program creates six subrecords. In line 30, the statement (1%\*37) AS DMS sets up a pointer to the beginning of each subrecord; the rest of the line describes each field within the record.

Program Listing 1 creates the random-access file described above to hold your data. Program Listing 2 reads the file sequentially. Whether you access the file randomly or sequentially, you always define fields as shown. You access the record using Get to call the full record. Then you use a file-handling program to locate the subrecord you want.

To write a record, you always fill the buffer using LSET (for left-justified data) or RSET (for right-justified data) with a specified subrecord position. These commands pad data that doesn't quite fill the buffer. Then you write the file to disk using Put with the main record number.

## Indexing Your Files

As you can see, reading and writing a random file sequentially isn't too complicated. However, to read a file randomly, your program must have a way to determine the main record number (which I call MR%) and the subrecord number (SR%) of the file in which you're interested. In other words, you need an index of the records stored in the random-access file. I use a sequential index file to point to the random records. It's easy to use and control, and has the advantage of letting you search the index by more than one key word.

One important aspect of random-access files to remember is that fields in random files are absolute in size; you use LSET or RSET to fill the fields to the right or left, with spaces added to fill the buffer. (A sequential file's fields generally vary in size with the data and use a delimiter, like a comma, to define the fields.)

Program Listing 3 demonstrates my indexing technique with a program that catalogues my applications programs. Listing 3 stores data in the fields shown in Table 2. It includes entries for the program name, author, application, and the disk on which it's stored. You could use the same procedure to create a file of names and phone numbers, candidates and votes received, and so on. I've listed all variables at the end of the

## The Key Box



Models I and III  
32K RAM  
Disk Basic  
NEWDOS80 (for sort)

Command	Description
Field	Defines buffer
LSET/RSET	Positions data in buffer
Put	Writes the buffer
Get	Reads the buffer
LOF	Sets pointer to last main record of file

Table 1. Commands for manipulating random files.

Position	Length (in bytes)	Description
1-12	12	Program name
13-16	4	Application
17-24	8	Disk name
25	1	Side
26-27	2	Grans
28-37	10	Author
38-57	20	Description

Table 2. Fields for program reference file.

*The index file  
controls access to  
the random file  
using the program's  
name as the key.*

program; they're for reference and shouldn't be typed in.

When you run the program, it displays a menu of three options: adding a new file, changing or deleting a file, or exiting the program. As you update records, the program creates a sequential index file in memory using arrays. The program writes out this index file at the end of the job; the file controls access to the random file and uses the program name as the key field.

Each index file record has the format XXXXXXXX/XXX, MR%, SR%; that is, the program name, the main record number (file or buffer number) and the subrecord number. The variables MR% and SR% of the index file point straight to the random record for any specific program name. Table 3 describes the main routines of Listing 3.

Program Listing 4 creates, sorts, and writes two index files from the main random file in Program Listing 3, one using the program name as the key word, the other using the application. Don't sort or change the index file; it controls the update procedure. The sort in lines 240 and 270 is a system sort available under NEWDOS80 2.0. Alternatively, you can insert a sort for your own DOS (for a TRSDOS sort, see "Proper Arrangements," June 1984, p. 96).

Program Listing 5 searches the random file in Program Listing 3 using the two index files created in Listing 4. By creating an index file that can have any field as the key, you can sort the file or access records in any sequence you want.

This technique has saved me the trouble of finding a good algorithm for randomizing the key field (which would have to be unique) into a main record and a subrecord. I feel that I have better control, and the pointers are so simple that they're less likely to get out of sync and send all my data into never-never land. This method should help programmers manipulate random files more easily and confidently. ■

You can reach Jane Goodale at 828 N. 121st St., Omaha, NE 68154.

Lines	Description
10-20	Initialize variables.
30	Read index file. If it doesn't exist, On Error routine takes care of it.
40-50	Initialize and field random file buffer. .
70-90	Menu.
100-190	Add to file. Last record added will be displayed first. To duplicate a field from previous record press the enter key. If a deleted record exists (*) in program name) the record is put there. Otherwise it's added at the end.
200-260	Change or delete. Asks for program name, displays the record, and positions cursor under each field in turn. Change field by entering new data, or leave as is by pressing enter. Delete record by typing asterisk (*) in the program name field. Line 260 returns to line 230 where 1% is stepped up to find the next occurrence of the same program name, which handles the duplicate key.
400-420	Locate the first deleted record.
500-570	Set variables for input routine.
600	Get data from the random file buffer based on subrecord number XS%.
700-720	Fill random file buffer.
750-760	Fill unused subrecords with x's.
800-810	On Error routine.
900-920	End of job. Writes index file. At this point, I run Listing 4 to create two more index files.
1000-1140	William Barden's Universal Gee Whiz Input routine. See <i>Programming Techniques for Level II Basic</i> , p. 57, for full discussion.

Table 3. Main routines for Program Listing 3.

Program Listing 1. Creates a random-access disk file. Add lines 10-40 from p. 106.

```

100  MR% = 1 ' initialize main record number
110  FOR SR% = 0 TO 5 ' six subrecords to fill
120  INPUT"ENTER NAME ( '*' TO EXIT );N$"
130  IF N$ = "*" THEN GOTO 210
140  INPUT"ENTER PHONE";P$
150  LSET NM$(SR%) = N$ ' fill buffer
160  LSET PH$(SR%) = P$
170  NEXT SR% ' step up subrecord number
180  PUT 1,MR% ' when six are filled, then Put
190  MR% = MR% + 1 ' now step up main record number
200  GOTO 110 ' and loop back
210  IF SR% = 0 THEN 230 ' first record
220  PUT 1,MR% ' otherwise write it out
230  CLOSE 1:END

```

End

Program Listing 2. Reads a random file sequentially. Add lines 10-40 from p. 106.

```

100  FOR MR% = 1 TO LOP
120  GET 1,MR%
130  FOR SR% = 0 TO 5
140  PRINT NM$(SR%), PH$(SR%) ' subscripted fields
150  NEXT SR%
160  NEXT MR%
170  CLOSE 1: ENO

```

End

Program Listing 3. Creates indexed random files.

```

1 REM RANDISKU/BAS JN GOODALE
2 REM      CREATE AND/OR UPDATE A RANDOM FILE OF PROGRAM
3 REM      AND DATA INFORMATION ON DISKS
4 REM
5 REM      INITIALIZE -----
6 CLEAR25000:CLS:PRINTTAB(15)"UPDATE PROGRAM INFORMATION FILE":PR
INT0340,"INITIALIZING":DEFINTA-Z:DIMIPS(500),IM%(500),IS%(500):E$=
"#:B2$="PROGRAM      APPL DISK      S GR AUTHOR      DESCRIPTION":B3$=STRINGS(63,"=")
7 MR% = 1:SR% = 0:N% = 0:FI$ = "DISKINDEX/INX:1":FR$ = "DISKINDEX/RND:1":ONER
8 RRGOTO 000:OPEN "I",1,FI$:
9 REM      READ INDEX -----

```

Listing 3 continued

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Listing 3 continued

```

38 INPUT#1,IPS$(N$),IN$(H$),IS$(H$):IFEOF(1)THEN40ELSEH$=N$+1:GOTO3
39 REM   INITIALIZE RANDOM FILE BUFFERS -----
40 CLOSE1:NR$=IM$(N$):SR$=IS$(N$):GOSUB420
50 OPEN"R",1,PR$;FIELD1,255 AS DX$;LSET DX$=STRINGS(255,"X"):FORI$=0TO3:FIELD1,(I$*57)AS DMS,12 AS PG$(I$),4 AS AP$(I$),8 AS DH$(I$)
,1 AS SDS(I$),2 AS GR$(I$),10 AS AUS(I$),20 AS DSS(I$):NEXTI$:IPHS$="Y":THEN108
69 REM   MAIN MENU -----
70 CLS:PRINTTAB(15)"UPDATE PROGRAM INFORMATION FILE":PRINT:PRINTTAB(B(2$))1 ADD TO FILE":PRINTTAB(2$)"2" CHANGE/DELETE":PRINTTAB(2$)"3" END PROGRAM:PRINT:PRINTTAB(1$)".... CHOICE (DO NOT HIT <ENTER> )";
88 KS=IN$EIS$:IPFS$=""THEN88ELSEPRINTRS$:ONVAL(R$)GOTO100,200,900
98 GOTO78
99 REM   ADD TO FILE -----
100 IPNS$="Y":THEN128ELSEIPFD$="Y":THEN128
110 GET1,NR$:$X$=SR$=GOSUB600:N$=N$+1:IFSR$=3THENSR$=0:MR$=MR$+1:LS$=SR$+1
120 CLS:PRINTTAB(93)"ADD TO FILE : ('*' TO ESCAPE, <ENTER> TO REPEAT)":PRINTN2$;PRINTH3$ 
130 IPD$="Y":TENGOSUB400:GOTO100ELSEIPHS$="Y":THEH145
140 PRINTPGS$;TAB(13)AP$;TAB(1B)DHS$;TAB(27)SD$;TAB(29)USING$;GR$;:PRINTTAB(32)AU$;TAB(43)DSS
145 FORI$=2TO13:XX=I$*64+12B:GOSUB500:IPZA$=""THEN108
150 XSA$=SR$:$X$=X$=N$=GOSUB700:IPSR$=3THENPUT1,NR$:$MR$=MR$+1:S$=0ELSESR$=SR$+1
160 H$="N":N$=N$+1:IPH$>500TRENN$=500:GOTO900
170 NEXTI$:GOTO128
180 N$=N$-1:IPSR$>8TENGOSUB750:SR$=SR$-1ELSENR$=NR$-1:SR$=3
190 GOTO79
199 REM   CHANGE/DELETE -----
200 CLS:PRINTTAB(24)"CHANGE/DELETE":PRINTTAB(12)"** TO DELETE",TAB(31)<ENTER> TO LEAVE AS IS":PRINTTAB(1B)"PROGRAM NAME :";:PS$="N" OT FOUND"
210 ZZ=12:ZC=161:GOSUB1000:IPZA$=""THEN78ELSEPGS$=ZAS:PRINT"":PGS$=PGS$+STRINGS(12-LEN(PGS)," ")
220 FORI$=0TON$:IPPGS$=IP$(I$)THEN248
230 NEXTI$:PRINT"":PRINTTAB(1B)"PROGRAM":PGS$;PS$:INPUT"....<ENTER> TO CONTINUE":E$=GOTO78
240 XSA$=IN$(I$):XSA$=IS$(I$):GET1,XN$:$X$=I$=GOSUB600:PRINT@192,B2$:
PRINTR3$;PRINTPGS$;TAB(13)AP$;TAB(1B)DHS$;TAB(27)SD$;TAB(29)USING$;GR$;:PRINTTAB(32)AU$;TAB(43)DSS
250 ZX=384:GOSUB500:IPZA$=""TBENPGS$=""":DS$="Y":DM$=XN$=DS$=XS$=DR$=I$=1
260 GOSUB700:PUT1,XN$=F$="" FINISBED":GOTO230
399 REM   LOCATE DELETED RECORD -----
400 DS$="N":ZX=192:GOSUB500:IPZA$=""THENDS$="Y":GOTO440
410 XSA$=DS$:$X$=DN$:$X$=DR$=GET1,DM$=GOSUB700:PUT1,DM$=420
420 FORI$=0TON$:IFIIP$(I$)=""THENDS$="Y":DM$=IN$(I$):DS$=IS$(I$):DR$=I$=1:GOTO440
430 NEXTI$=440
440 RETURN
449 REM   SCREEN LAYOUT AND INPUT -----
500 ZZ=12:ZC=ZX:GOSUB1000:IPZA$=""THEN578ELSEIPZA$<>""THENPGS$=ZAS
510 ZZ=4:ZC=ZX+13:GOSUB1000:IPZA$=""THEN578ELSEIPZA$<>""THENAP$=ZAS
520 ZZ=8:ZC=ZX+18:GOSUB1000:IPZA$=""TREN578ELSEIPZA$<>""THENND$=ZAS
530 ZZ=1:ZC=ZX+27:GOSUB1000:IPZA$=""THEN578ELSEIPZA$<>""TRENDS$=ZAS
540 ZZ=2:ZC=ZX+29:GOSUB1000:IPZA$=""THEN578ELSEIPZA$<>""THENGR$=VAL(ZA$)
550 ZZ=10:ZC=ZX+32:GOSUB1000:IPZA$=""THEN578ELSEIPZA$<>""THENAUS$=ZAS
560 ZZ=20:ZC=ZX+43:GOSUB1000:IPZA$=""THEN578ELSEIPZA$<>""THEND$=ZAS
570 RETURN
599 REM   DEFINE DATA -----
600 PG$=PGS$(XS$):AP$=AP$(XS$):DH$=DHS$(XS$):SD$=SD$(XS$):GR$=CVI(GRS$(XS$)):ADS=AU$(XS$):DS$=DSS$(XS$):RETURN
699 REM   FILL BUFFER -----
700 LSETPGS$(XS$)=PGS$;LSETAP$(XS$)=AP$;LSETDHS$(XS$)=DH$;LSETSD$(XS$)=SD$;LSETGR$(XS$)=GR$;LSETAU$(XS$)=AU$;LSETDSS$(XS$)=DS$=710
710 IPS$(X$)=PGS$(XS$):IM$(X$)=XN$=IS$(X$)=XS$=720
720 RETURN
749 REM   FILL UNUSED SUB RECORDS
750 X$=H$+1:$X$=NR$:PC$="X":AP$="X":DH$="X":SD$="X":GR$="0":AU$="X":DS$="X"
760 FORI$=SR$+1TO3:GOSUB700:NEXTX$=PUT1,NR$=RETURN
799 REM   ON ERROR ROUTINE
800 IPERL=29TRENN$="Y":RESUME50
810 PRINT"ERROR ";ERR/2+1;" IN LINE ";ERL:END
899 REM   END -----
900 CLOSE1:OPEN"D",1,PI$;PRINT"CREATING RANDOM INDEX FILE"
910 FORI$=0TON$:PRINT#1,IPS$(I$),";",IN$(I$),";",IS$(I$):NEXTI$:CLO$E1

```

Listing 3 continued

Listing 3 continued

```

920 CLS:PRINT"END OF UPDATE .... NOW RUNNING PROGRAM INDEX":RUN"RA
NDISK1/BAS"
999 REM BARDEN'S INPUT ROUTINE -----
1000 ZA$=STRINGS(ZZ, ".") : PRINT#ZC, ZA$; CHRS(14) : ZA=LEN(ZA$) : FORZF=
1TOZA:PRINTCHR$(24) : :NEXTZF:ZA$=STRINGS(ZA,32):ZG=1
1010 ZR$=INKEYS:IFZNS=""TREN1@10
1020 IFZNS=CNRS(0)ORZNS=CRRS(9)ORZNS=CRRS(13)GOTO1@48
1030 IFZBS<CBRS(32)GOTO1@10
1040 IFZNS<>CNRS(0)GOTO1@70
1050 IFZG=1GOTO1@10ELSEPRINTCHR$(24):
1060 ZG=ZG-1:GOTO1@18
1070 IFZNS<>CNRS(9)GOTO1@90
1080 IFZG>=ZACOTO1@10ELSEPRINTCHR$(25) : :ZG=ZG+1:GOTO1@10
1090 IFZBS<>CHRS(13)GOTO1@10ELSEPRINT#ZC,CBR$(15):STRINGS(ZA+1,32)
,:PRINT#ZC, ZA$; : ZA$=LEFT$(ZA$, ZG-1):RETURN
1100 ZG=ZG+1
1110 IFZG>ZA+1PRINTCHR$(24):
1120 IFZG>ZA+1ZG=ZG-1
1130 PRINTZBS; : IFZNS=","THENZHS=CNRS(129)ELSEIFZHS=":"THENZHS=CNRS
(130)
1140 ZA$=LEFT$(ZA$, (ZG-2))+ZNS+RIGHT$(ZA$, ZA-ZG+1):GOTO1@10
1200 REM
1210 REM      VARIABLE LIST
1220 REM      VARIABLE      DESCRIPTION
1230 REM -----
1240 REM      AP$( )      APPLICATION IN SUB RECORD
1250 REM      AU$( )      AUTHOR IN SUB RECORD
1260 REM      DS          DELETE SWITCH
1270 REM      DM$         DUMMY RECORD FOR BUFFER
1280 REM      DM#         MAIN RECORD NUMBER OF DELETED RECORD
1290 REM      DN$( )      DISK NAME IN SUB RECORD
1300 REM      DS$( )      DESCRIPTION IN SUB RECORD
1310 REM      DS#         SUB RECORD NUMBER OF DELETED RECORD
1320 REM      DX$         DUMMY STRING FOR START-UP
1330 REM      ES          EDIT STRING
1340 REM      FS          COMMENT STRING ('NOT FOUND' OR 'FINISHED')
1350 REM      FIS         FILE SPEC OF INDEX FILE
1360 REM      PR$         FILE SPEC OF RANDOM FILE
1370 REM      GR$( )      GRANS (OBTAINED FROM MRI$(GR$) IN SUB RECO
RD
1380 REM      GR$         GRANS
1390 REM      H2$         HEADING
1400 REM      N3$         HEADING
1410 REM      I$          TEMP - USEO IN FOR NEXT LOOPS
1420 REM      IN$( )      MAIN RECORD NDMBER IN INDEX FILE
1430 REM      IP$( )      PROGRAM NAME IN INDEX FILE
1440 REM      IS$( )      SUB RECORD NUMBER IN INDEX FILE
1450 REM      KS          TEMP - INREYS
1460 REM      NR$         MAIN RECORD NUMBER
1470 REM      NS          NEW FILE SWITCH ("Y" IF NEW FILE)
1480 REM      N$          NUMBER OF RECORDS ON INDEX FILE
1490 REM      PG$( )      PROGRAM NAME IN SUB RECORD
1500 REM      SD$( )      SIDE IN SUB RECORD
1510 REM      SR$         SUB RECORD NUMBER
1520 REM      X$          TEMP - I$ IN SUBROUTINE 700
1530 REM      XN$         TEMP - NR$ IN SUBROUTINE 700
1540 REM      XS$         TEMP - SR$ IN SUBROUTINE 700
1550 REM      ZA          TEMP - USED IN INPUT ROUTINE 1000
1560 REM      ZA$         TEMP - RESULTS OF INPUT ROUTINE
1570 REM      ZC          TEMP - CURSOR POSITION FOR INPUT ROUTINE
1580 REM      ZF          TEMP - USED IN INPUT ROUTINE
1590 REM      ZG          TEMP - USED IN INPUT ROUTINE
1600 REM      ZH$         TEMP - USEO IN INPUT ROUTINE
1610 REM      ZX          TEMP - POINTS TO BEGINNING OF LINE FOR INP
UT
1620 REM      ZZ          TEMP - LENGTH OF FIELD FOR INPUT ROUTINE

```

End

Program Listing 4. Adds and sorts two indexes.

```

1 REM RANDISK1/BAS          JN GOODALE      03/27/82
3 REM      CREATE REY INDEX FILES FOR FIELDS
4 REM      OF A RANDOM FILE.
9 REM      INITIALIZE .....
10 CLEAR23000:DEFINTA-Z:DINIP$(500),IA$(500),IN$(500),IS$(500),S$(500)
20 FR$="DISKINDEX/RND:1":CLS:PRINT"READING PROGRAM INFORMATION FILE
50 OPEN"R",1,FR$:FIELD1,255 AS DX$:LSET DX$=STRINGS(255,"X") :FORI$=1TO3:FIELD1,(I$*57) AS DM$,12 AS PG$(I$),4 AS AP$(I$),0 AS DN$(I$)
,1 AS SD$(I$),2 AS GR$(I$),10 AS AU$(I$),20 AS DS$(I$):NEXTI$:
100 NS=0:FORMR$=1TOLOF(1):GET1,NR$=0:FORSR$=0TO3
110 FORSR$=0TO3

```

Listing 4 continued

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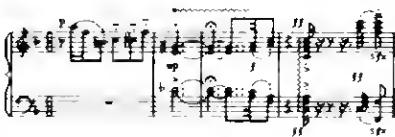
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*Listing 4 continued*

```

120 IM$ (N%) = SR% : IS% (N%) = SR% : IP$ (N%) = PG$ (SR%) : IA$ (N%) = AP$ (SR%)
130 N% = N% + 1
140 NEXTSR%
150 NEXTMR% : N% = N% - 1
199 REM MAIN ROUTINE .....
200 CLOSE1:FI$ = "DISKINDX/INA:1":GOSUB240:W=1:W$ = "APPLICATION":GOSU
B300
210 FIS = "DISKINDX/INP:1":GOSUB270:W=2:W$ = "PROGRAM":GOSUB300
230 GOTO900
240 CMD "O", S% + 1, *S% (0), IA$ (0) : RETURN
270 CMD "O", S% + 1, *S% (0), IP$ (0) : RETURN
299 REM DO IT .....
300 PRINT:PRINT"WRITING : ";W$ : OPEN "O", 1, FI$ 
310 FOR I% = 0 TO N% : S% = S% (I%) 
320 ONWGOTO330, 340
330 F$ = IA$ (S%) : GOTO360
340 F$ = IP$ (S%) : GOTO360
360 PRINT#1, PS; ", ; IM$ (S%); ", ; IS$ (S%)
370 NEXTI% : CLOSE1:RETURN
899 REM END OF JOB .....
900 PRINT" :PRINT"END OF JOB"
920 END

```

*End*

*Program Listing 5. Searches random file using indexes created by Listing 4.*

```

1 REM LOOKDISK/BAS JN GOODALE
3 REM SEARCH AND DISPLAY RANDOM FILE OF PROGRAM
4 REM INFORMATION USING A SEQUENTIAL FILE TO
5 REM REFERENCE THE RECORDS
9 REM INITIALIZE .....
10 CLEAR20000:CLS:PRINTTAB(15)"SEARCH/DISPLAY PROGRAM INFORMATION FILE":PRINT#340,"INITIALIZING":DEFINTA-Z:DIMIP$(500),IM$(500),IS$(500):E$="#":H2$="PROGRAM" APPL DISK S GR AUTOR DESCRIPTON":B3$=STRINGS(63,"=")
20 FR$="DISKINDX/RND:1"
30 CLS:PRINTTAB(20)"SEARCH/DISPLAY PROGRAM":PRINT:PRINTTAB(15)"USING ONE OF THE FOLLOWING KEYS :":PRINTTAB(20)"1" PROGRAM":PRINTTAB(20)"2" APPLICATION"
40 PRINT:PRINT"ENTER CHOICE (DO NOT HIT <ENTER>) --> ";
50 KS=INKEY$:IF KS=""THEN50ELSEPRINTKS:ONVAL(K$)GOTO80,90
60 GOTO30
60 L=12:C$="PROGRAM NAME":C=1:FI$="DISKINDX/INP:1":GOTO120
90 L=4:C$="APPLICATION":C=2:FI$="DISKINDX/INA:1":GOTO120
120 N% = 0:OPEN "I", 1, FI$ 
130 INPUT#1, IP$(N%), IM$(S%), IS$(S%):IF EOF(1) THEN140ELSE N% = N% + 1:GOT
130
140 CLOSE1:OPEN "R", 1, FR$:FIELD1, 255 AS DX$:LSET DX$=STRINGS(255,"X"):FOR I% = 0 TO 3:FIELD1,(I%*57) AS DM$, 12 AS PG$(I%), 4 AS AP$(I%), 8 AS DNS$(I%), 1 AS SD$(I%), 2 AS GR$(I%), 10 AS AU$(I%), 20 AS DS$(I%):NEXT
150 CLS:PRINTTAB(15)"DISPLAY PROGRAM INFORMATION FILE":PRINT:PRINTTAB(20)"1" SEARCH":PRINTTAB(20)"2" DISPLAY ALL":PRINTTAB(20)"3" RESTART":PRINTTAB(20)"4" END":PRINT:PRINT" .... CHOICE (DO NOT HIT <ENTER>) ...> ";
160 KS=INKEY$:IF KS=""THEN160ELSEPRINTKS:ONVAL(K$)GOTO180,240,460,4
70
170 GOTO150
180 CLS:PRINTTAB(20)"SEARCH ON : ";C$:PRINT
190 PRINT"ENTER ";C$:INPUTS$:LC% = 1:B1$ = S$:LM% = 0:GOSUB410
200 S$ = S$ + STRINGS(L-LEN(S$), " "):FOR I% = 0 TO N% : IP$ = IP$(I%):THENGOSUB
300
210 NEXTI%:GOSUB360:GOTO150
240 LC% = 1:CLS:PRINTTAB(10)"DISPLAY FILE IN SEQUENCE BY :";C$:HIS=C
$ 
290 GOSUB410:LM% = 0:FOR I% = 0 TO N% : MR$ = IM$(I%):SR$ = IS$(I%):GOSUB310:NE
XTI%:PRINT"END OF FILE":GOSUB380:GOTO150
300 MR$ = IM$(I%):SR$ = IS$(I%)
310 IF MR$ <> LS$ THEN GET1, MR%
320 LM% = MR%:XS$ = SR$:GOSUB440
330 PRINTPGS$;TAB(13)APS$;TAB(16)DNS$;TAB(27)SD$;TAB(29)USINGES$;GR%:;
PRINTTAB(32)AU$;TAB(43)DS$ 
340 IF INT(LC%/10) = LC%/10 THEN390ELSEIF KS = "Q" THENGOTO150
350 LC% = LC% + 1:RETURN
360 PRINT"END SEARCH ON ";S$:GOSUB380:RETURN
370 REM CONTINUE OR QUIT PROMPT .....
380 PRINT#960,".. 'Q' TO QUIT .... <ENTER> TO CONTINUE ";
390 KS=INKEY$:IF KS=""THEN390ELSEIF KS = "Q" THENGOTO150
400 RETURN
410 CLS:PRINTTAB(10)"PROGRAM INFORMATION FILE BY ";R1$ 
420 PRINT:PRINTB2$;PRINTR3$:RETURN
430 REM DEFINE DATA -----
440 PG$ = PG$(XS%):APS = AP$(XS%):DNS = DNS$(XS%):SD$ = SD$(XS%):GR% = CVI(GR
S$(XS%)):AU$ = AU$(XS%):DS$ = DS$(XS%):RETURN
450 REM END OF JOB .....
460 RUN
470 CLOSE1:PRINT" :PRINT"END OF JOB";

```

*End*



# PATCH WORK

You get a paging directory, pause control for program listings, full error messages, file identification with the Auto command, and more with these 13 patches to TRSDOS 1.3.

Tired of TRSDOS 1.3? If your answer is yes, take comfort in the fact that you're not alone. While Model III TRSDOS is a vast improvement over TRSDOS 2.3, it isn't perfect. I've developed a series of patches, however, that promise to smooth some of TRSDOS 1.3's rough edges.

The 13 patches included here make TRSDOS 1.3 a more efficient operating system. They give you an abridged TRSDOS directory, correct a TRSDOS bug for nonexistent files, display a directory one page at a time, pause a program or directory listing with the same command, eliminate the need for a colon with the Directory command, identify a file you load with the Auto command, list free disk space in detail, provide full error messages, refine the TRSDOS Ready prompt, change the TRSDOS boot-up banner, administer a better formatting test for new disks, and eliminate TRSDOS's "Operation Aborted" message. You don't have to install all the patches; rather, you can pick and choose as you please.

## The Patches

You install the patches with the TRSDOS Patch command. It's simple to use. Start at TRSDOS Ready, type in the patches you want, check for typographical errors, and press the enter key to finish the command. If you get an error message, try to figure out what went wrong before continuing. You must copy all the command lines listed in the patch you select. For example, if the patch consists of four patch lines, you must enter all four lines, as four separate TRSDOS commands. Don't enter any other DOS commands until you've completed all patching.

Patch 1, the Catalogue command, gives you an abridged directory from the TRSDOS Ready prompt, eliminating the problems associated with TRSDOS

1.3's Directory command. Patch 1 eliminates TRSDOS's Route command and "Operation Aborted" message, so it doesn't use additional disk, directory, or memory space. The directory listing, however, isn't as complete as the original TRSDOS listing.

To install this patch correctly, first make sure that your TRSDOS 1.3 short directory routine in Basic works and then type in the patch. To call the new command, type CAT or CAT (drive number) from TRSDOS Ready, and press the enter key.

Note that section (a) of Patch 1 contains the two patches issued by Radio Shack (see *TRS-80 Microcomputing News*, October 1981, p. 13). Ignore section (a) if you've already incorporated this change. Type in the patch as listed:

(a) Radio Shack fix:

PATCH \*10 (ADD = 4E2E, FIND = CD3E4B,  
CHG = CD8A50)

PATCH \*10 (ADD = 50A8, FIND = 4469736B,  
CHG = 4FC33E4B)

(b) The Catalogue command:

PATCH \*1 (ADD = 50A9, FIND = 4F7065726174,  
CHG = 0D7EFE343004)

PATCH \*1 (ADD = 50AF, FIND = 696F6E204162,  
CHG = FE3030023E30)

PATCH \*1 (ADD = 50B5, FIND = 6F727465640D,  
CHG = 327142C31944)

PATCH \*1 (ADD = 51C9, FIND = 524F55544520  
A842, CHG = 434154202020AA50)

Patch 2 fixes a bug in TRSDOS 1.3 that results when TRSDOS tries to list nonexistent files in the disk directory hash index table. The code for Patch 2 is:

PATCH \*10 (ADD = 4E47, FIND = 02, CHG = 03)

Patch 3 modifies the Directory com-

mand so that it displays directory files one page at a time. Once you install this patch, type in DIR, press the enter key and the usual long-format directory appears. However, if there are too many entries for one screen, the listing stops and waits for you to press the enter key before displaying the next set of entries. Type in Patch 3 as listed here:

PATCH \*6 (ADD = 616D, FIND = CD8861B7C8  
FE40, CHG = 3A803FD620C8CD)

PATCH \*6 (ADD = 6174, FIND = 2806C547AF78  
C1, CHG = 7C61CDC901AFC9)

Patch 4 applies to TRSDOS 1.3's List command. When you list a file from TRSDOS Ready, the display scrolls unless you pause the listing by pressing the @ key. This patch changes the pause control to the shift-@ key combination. The command is the same as that in Basic, and therefore much easier to remember. The code for Patch 4 is:

PATCH \*11 (ADD = 5265, FIND = 40, CHG = 60)

Patch 5 is similar to Patch 4 except that it applies to TRSDOS 1.3's Directory command. It lets you pause a long-format directory listing by pressing the shift and @ keys at the same time, rather than pressing the @ key alone. The reason for this patch is compatibility: It makes the pause control for both the Basic List and the Directory commands the same. Patch 5 shouldn't be applied if you've installed Patch 3. Here's the code for Patch 5:

PATCH \*6 (ADD = 6173, FIND = 40, CHG = 60)

Patch 6 gives you the option of including (or not including) a colon when naming the disk drive for the Directory command. The code is:

PATCH \*6 (ADD = 59EC, FIND = 7FEFE3A2015,  
CHG = 2BCD781D38)

PATCH \*6 (ADD = 59F1, FIND = 237ED630DA,  
CHG = 06FE3A2010)

PATCH \*6 (ADD = 59F6, FIND = 3452FE04D2,  
CHG = 237ED630DA)

## The Key Box

Model III  
TRSDOS 1.3



Patch 7 works with the Auto command. When you use the Auto function, your computer displays the name of the file you're automatically loading, rather than just the message "Auto Function Engaged." Type in this patch as:

PATCH \*0 (ADD = 4F60, FIND = 6B4F,  
CHG = 2542)

Patch 8 not only tells you where you have free disk space, but also the amount of space, in grams, available. To make room for this patch, I had to modify the password message of the Prot (PW) command. After you add Patch 8, you're asked "New Master?" instead of "New Master Password?" The code for Patch 8 is:

PATCH \*6 (ADD = 5D52, FIND = FE28D0,  
CHG = CD4555)

PATCH \*6 (ADD = 5542, FIND = 2050617373,  
CHG = 3F2003FE28)

PATCH \*6 (ADD = 5547, FIND = 776F72643F,  
CHG = D8F1C3FC5B)

Patch 9 is a one-byte patch that makes an entire error message appear rather than the error number. Once this patch is in place, you'll see the message without having to enter another command. The code for this patch is:

PATCH \*4 (ADD = 4E28, FIND = 20, CHG = 18)

Patch 10 eliminates the row of dots that TRSDOS 1.3 displays after the TRSDOS ready prompt. The code for this patch is:

PATCH \*1 (ADD = 4E75, FIND = 063E3E,  
CHG = C37E4E)

Patch 11 shortens the TRSDOS 1.3 opening banner from a picture of the computer to a single line. It also skips the time and date prompts when you boot-up. A minor problem with this patch is that new files created usually have garbage for the date, although the file itself isn't affected. If this bothers you, install only the first three of the four patch lines for Patch 11. The code is as follows:

PATCH \*0 (ADD = 5039, FIND = 20, CHG = 0D)

PATCH \*0 (ADD = 508A, FIND = 28, CHG = 0D)

PATCH \*0 (ADD = 516C, FIND = D0, CHG = 0D)

PATCH \*0 (ADD = 4EA9, FIND = CA, CHG = C3)

Patch 12 provides a better formatting test for new disks. Once you install Patch 12, you can expect more disks to fail the formatting test, but it's better to lose a marginal disk than to lose your important data. Here's the code for Patch 12:

PATCH \*7 (ADD = 5BEE, FIND = E5, CHG = 5B)

Patch 13 eliminates the "Operation Aborted" message. Don't apply this patch if you've already installed Patch

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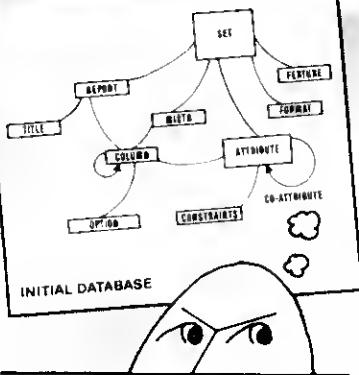
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*Patching is an easy way to change a file; all you have to do is copy and enter a few lines of text.*

## 1. The code for Patch 13 is:

PATCH \*1 (ADD = 50A9, FIND = 4F, CHG = 0D)

One final note—the patches won't take effect until you reboot your disk.

## Before Patching

When installing a new patch, always use a back-up disk as the Patch command permanently modifies the machine-language system programs stored on disk. Only patch more important disks when you're sure that the patches work as expected; a typographical error could ruin your disk in seconds. If you've applied non-Radio Shack patches to TRSDOS 1.3, the patches given here might not work.

One way to avoid errors is to create a do-file. With the Do and Build commands, you only have to type in the patches once. The do-file is then used to correctly patch as many disks as desired. The procedure for using these commands is explained in the TRSDOS 1.3 manual (also see Douglas Payne's "Brick by Brick," 80 Micro, April 1984, p. 58).

Another option is to use a word processing program to create and edit do-files. A do-file is an ASCII file and most word processing programs work with ASCII files. All you have to do is write command lines, each with 63 characters (or fewer), and a carriage return at the end. Then save the file in ASCII format. You should select a file name ending with the /BLD extension. With a word processor, you can create a master file containing all of the patches listed here. From this master file you can delete and combine the various lines to create new, customized do-files that contain the specific patches that you want to install.

## Understanding the Patch Command

The Patch command changes information at a specific location in a disk file. It's an easy way to change a file

since all you have to do is copy and enter a few lines of text. The programmer, on the other hand, must first determine what changes you want made, and then must find available space in the program file to apply those changes. If the file is full, then you must overwrite existing Z80 computer instructions with the new patches. The command format for a patch is as follows: PATCH file-name (ADD = XXXX, FIND = YY, CHG = ZZ).

The first item of information is the file name, necessary so that TRSDOS can find the file and apply the patch. Because TRSDOS 1.3 system files don't have file names, use the format, \*#.\$, to identify the decimal number (#) and disk drive (\$) of that system file.

The second item of information in the Patch command indicates where you should make the changes. This information is provided by ADD = XXXX, the next variable on the command line. The "XXXX" is a hexadecimal number representing a memory address. The third item, "FIND = YY", reveals the contents of the disk file at that patch location. Again, the "YY" represents a hexadecimal number; it's possible to have more than one hexadecimal number in a Patch command.

You should know what's on the disk before installing a patch because TRSDOS 1.3 won't complete the patch if the numbers indicated in Find don't match those on the disk file. The advantage of patching with TRSDOS 1.3 is that while it may take longer, it's almost impossible to install a patch in the wrong location.

The final item of the patch format command, "CHG = ZZ", indicates the new information you want on disk. In doing this, TRSDOS 1.3 checks to make sure that the number of Find bytes you need are equal to the number of Find bytes available. If there's no match, the command is aborted with an error message. Otherwise TRSDOS writes the "CHG" bytes to the disk file where the Find bytes had been. The actual switch is made in memory and then written to disk as a modified file sector. For this reason, you can't write-protect your disk when you're patching a file. If you're skilled in hexadecimal math and machine language, you can make minor modifications to a machine-language program without having to re-create the file with an editor/assembler. ■

Write to Andy Levinson at 11575 Sunshine Terrace, Studio City, CA 91604.

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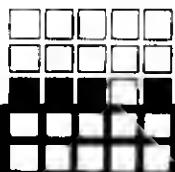
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## Using Cubic

Type in and save Cubic (see Program Listing 1, 2, or 3, depending on your sys-

tem). When you run the program, it displays the prompt seen in the Figure. Cubic always displays the formula for a cubic equation (where the greatest exponent is three) and prompts you to enter values for the variables A, B, C, and D.

To solve for a quadratic equation (where no exponent exceeds 2), you need to zero out the first term in the equation by entering a zero for the value of A.

For a linear algebraic equation (no exponent), enter a zero for both the coefficients A and B.

As an example, consider the cubic equation  $X^3 + 3X^2 - 4X - 12 = 0$ . Coefficient A equals 1 because there's only one X to the power of three, B equals three because there are three X's squared, C equals negative four because four X's are subtracted, and D equals the constant -12. To solve this equation, you enter the values 1, 3, -4, -12, at the coefficient prompt.

Once you enter the coefficients, Cubic displays the real roots of the equation. There are three solutions to this sample problem: 2, -2, and -3.

Cubic then lets you check the veracity of these numbers by prompting you to substitute a number for X in the equation ("CHECK#?"). You can thus reenter and verify Cubic's solutions. This is handy for rechecking suspicious answers.

Consider this quadratic equation:  $-2X^2 + 11X - 15 = 0$ . The coefficients here are A=0, B=-2, C=11, and D=-15. The first coefficient is zero because there's no  $X^3$  term in the quadratic equation; any term not present is considered to have a coefficient of 0. The two solutions to this quadratic are  $X_1 = 2.5$  and  $X_2 = 3$ .

## Complex Roots

Cubic also works with complex roots. Consider this equation:  $X^2 - 6X + 25 = 0$ . The coefficients are 0, 1, -6, 25, while the solutions are the two complex conjugates  $3 + 4i$  and  $3 - 4i$ , displayed

THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS  
OF THE STANDARD FORM:  $F(X) = A*X^3 + B*X^2 + C*X + D$   
PLEASE INPUT THE COEFFICIENTS A,B,C,D ? 1,3,-4,-12

THE FIRST REAL ROOT IS  $X_0 = 2$   
THE OTHER 2 ROOTS ARE  
 $X_1 = -2$   
 $X_2 = -3$   
Press <ENTER> to END program. CHECK #? -2  
 $F(-2) = 0$   
Press <ENTER> to END program. CHECK #?  
READY

Figure. Cubic prompts you to enter equation coefficients, then solves for the equation's roots.

### Program Listing 1. Cubic for the Model I.

```
0 ' CUBIC/I VERS 2/15/84 by Mike O'Neal
30 PRINT"THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS"
40 PRINT"OF THE STANDARD FORM:  $F(X) = A*X^3 + B*X^2 + C*X + D$ "
50 INPUT"PLEASE INPUT THE COEFFICIENTS A,B,C,D ";A3,A2,A1,A0
60 PRINT:IFA3<>0THEN100
70 IFA2<>0THENNA=A2:B=A1:C=A0:PRINT"THE ONLY ROOT IS X = ";-A0/A1:END
80 IFA1=0THEN50
90 PRINT"THE ONLY ROOT IS X = ";-A0/A1:END
100 'CUBIC
110 S=1:L=0:P=1
120 S=1-S:L=1-L:GOSUB300:IFYS<>YLTHEN140
130 S=-S:L=-L:GOSUB300:IFYS<>YLTHEN120
140 N=(S+L)/2:GOSUB290:IFYS<>YHTHENL=HSESES=H
150 IFABS(L-S)<PTBENP=ABS(L-S):GOTO140
160 PRINT"THE FIRST REAL ROOT IS  $X_0 =$ ";N:PRINT"THE OTNER";
```

*Listing 1 continued*

### The Key Box



Models I, III, 4, 1000, and 2000  
16K RAM Cassette Basic  
32K RAM Disk Basic

## Using the quadratic formula, Cubic solves the remaining equation.

as  $3 \pm 4i$  (i stands for imaginary, meaning the square root of negative one).

To solve  $X^3 = -9$ , substitute 0, 1, 0, 9 into the program for the result  $X = 3i$  or  $X = -3i$ .

### Program Structure

Programmers will notice that Cubic uses the notation  $X*X*X$  to cube a number instead of  $X^3$ , which calls the computer's built-in exponent capability. My reasoning here is that it's more efficient for Basic to multiply the numbers when the exponent is small. With the built-in exponent function, Basic first must logarithmically convert both the X and the power, then multiply the two numbers together, taking the inverse log to obtain the result.

Cubic first must determine if it's solving a cubic, quadratic, or simple linear equation. Line 100 of all three listings initiates the search for the point where the function crosses the X-axis. Once the first zero is located, Cubic puts the equation into its quadratic form. Using the quadratic formula, Cubic then solves the remaining equation. If the equation is already quadratic, Cubic jumps to line 190; if it's a linear equation, Cubic uses simple algebra to solve for the answer at line 90.

### Cubic Versions

I've included three versions of Cubic: The first version (Program Listing 1) is for the Model 1 Level II tape or disk system, the second version (Program Listing 2) is for Model III Disk Basic, the third version (Program Listing 3) applies to the Models 4, 1000, and 2000. Model 1000 and 2000 users must change the CHR\$(127) in line 260 of Program Listing 3 to CHR\$(241).

If you have a Model III tape system simply use Program Listing 1 and substitute line 260 of Program Listing 2 for line 260 of Program Listing 1. This lets you take advantage of the special algebraic symbol, the plus/minus. In addition, Cubic runs on minimum memory system as the Program Listings are only about 1K in length. ■

Write to Mike O'Neal at 220 N. College Avenue, #18, College Place, WA 99324.

Listing 1 continued

```

170 'SYNTHETIC DIVISION
180 A=A3:B=R*A+A2:C=R*B+A1
190 'QUADRATIC
200 PRINT" 2 ROOTS ARE ";
210 D=B*B-4*A*C:IF D<0 THEN 240
220 X1=(-B+SQR(D))/(2*A):X2=(-B-SQR(D))/(2*A)
230 PRINT:PRINT"X1 = ";X1:PRINT"X2 = ";X2:GOTO270
240 FNINT"THE COMPLEX CONJUGATES:":D=-D
250 XR=-B/(2*A):XI=SQR(D)/ABS(2*A)
260 PRINTXR+"XI"Y":PRINTXR"-XI"Y"
270 S=9999999:INPUT"PRESS <ENTER> TO END PROGRAM, CHECK #":S
280 IFS=9999999ENDELSEGOSUB310:PRINT" F ("S") = ";Y:GOTO270
290 YN=SGN(A3*R*B*R+A2*R*R+R+A1*R+A0)
300 YL=SGN(A3*L*L*L+A2*L*L+L+A1*L+A0)
310 Y=A3*S*S*S+A2*S*S+A1*S+A0:YS=SGN(Y):RETURN

```

End

### Program Listing 2. Cubic for the Model III.

```

0 ' CUBIC/III VERS 2/15/84 by Mike O'Neal
10 DEF FN A(X)=A3*X*X*X+A2*X*X+A1*X+A0
20 DEF FN B(X)=SGN(FN A(X)):CC=32
30 PRINT"THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS"
40 PRINT"OF THE STANDARD FORM: F(X) = A*X^3 + B*X^2 + C*X + D"
50 INPUT"PLEASE INPUT THE COEFFICIENTS A,B,C,D ";A3,A2,A1,A0
60 PRINT:IFA3<>0,100
70 IFA2<>0,A=A2:B=A1:C=A0:PRINT"THE":GOTO198
80 IFA1=0,50
90 FNINT"THE ONLY ROOT IS X = ";-A0/A1:END
100 'CUBIC
110 S=1:L=0:P=1
120 S=1-S:L=1-L:IFFNB(S)<>FNB(L),140
130 S=-S:L=-L:IFFNB(S)=FNB(L),120
140 R=(S+L)/2:IFFNB(S)<>FNB(R),L=NELSE S=R
150 IFABS(L-S)<P,P=ABS(L-S):GOTO140
160 PRINT"THE FIRST REAL ROOT IS X0 = ";R:PRINT"THE OTHER";
170 'SYNTHETIC DIVISION
180 A=A3:B=R*A+A2:C=R*B+A1
190 'QUADRATIC
200 PRINT" 2 ROOTS ARE "
210 D=B*B-4*A*C:IFD<0,240
220 X1=(-B+SQR(D))/(2*A):X2=(-B-SQR(D))/(2*A)
230 PRINT"X1 = ";X1:PRINT"X2 = ";X2:GOTO270
240 PRINT"THE COMPLEX CONJUGATES: ";D=-D
250 XR=-B/(2*A):XI=SQR(D)/ABS(2*A)
260 PRINTXR,CHR$(127),STR$(XI),CHR$(105)
270 S=999999:INPUT"Press <ENTER> to END program. CHECK #":S
280 IFS=9999999ENDELSEPRINT" F ("S") = ";FN A(S):GOTO270

```

End

### Program Listing 3. Cubic for the Models 4, 1000, 2000.

```

0 ' CUBIC/4
10 DEF FN A(X)=A3*X*X*X+A2*X*X+A1*X+A0
20 DEF FN B(X)=SGN(FN A(X)):CC=32
30 PRINT"THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS"
40 PRINT"OF THE STANDARD FORM: F(X) = A*X^3 + B*X^2 + C*X + D"
50 INPUT"PLEASE INPUT THE COEFFICIENTS A,B,C,D ";A3,A2,A1,A0
60 PRINT:IF A3<>0 THEN 100
70 IF A2<>0 THEN A=A2:B=A1:C=A0:PRINT"THE":GOTO 198
80 IF A1=0 THEN 50
90 PRINT"THE ONLY ROOT IS X = ";-A0/A1:END
100 'CUBIC
110 S=1:L=0:P=1
120 S=1-S:L=1-L:IF FN B(S)<> FN B(L) THEN 140
130 S=-S:L=-L:IF FN B(S)= FN B(L) THEN 120
140 R=(S+L)/2:IF FN B(S)<> FN B(R) THEN L=R ELSE S=R
150 IF ABS(L-S)<P, P=ABS(L-S):GOTO 140
160 PRINT"THE FIRST REAL ROOT IS X0 = ";R:PRINT"THE OTHER";
170 'SYNTHETIC DIVISION
180 A=A3:B=R*A+A2:C=R*B+A1
190 'QUADRATIC
200 PRINT" 2 ROOTS ARE "
210 D=B*B-4*A*C:IF D<0 THEN 240
220 X1=(-B+SQR(D))/(2*A):X2=(-B-SQR(D))/(2*A)
230 PRINT"X1 = ";X1:PRINT"X2 = ";X2:GOTO 270
240 PRINT"THE COMPLEX CONJUGATES: ";D=-D
250 XR=-B/(2*A):XI=SQR(D)/ABS(2*A)
260 PRINT XR,CHR$(127),STR$(XI),CHR$(105)
270 INPUT"CHECK #":S
280 PRINT" F ("S") = "; FN A(S):GOTO 270

```

End

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**See opposite page** ►►►►

# **"DDC"**

## **Double Density Controller**

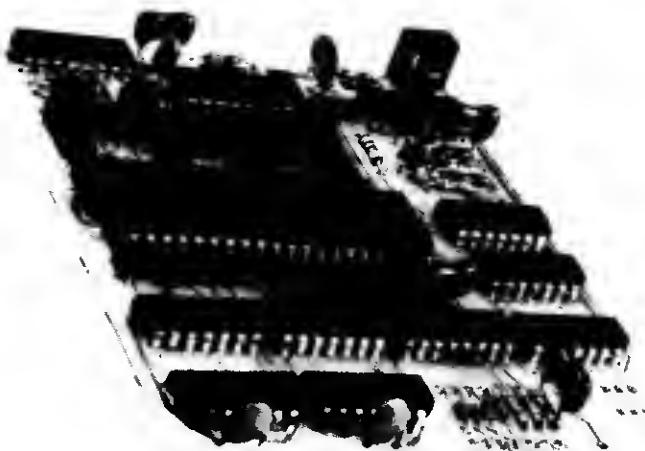
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# Desirable Interruptions: A I/III/4 Interrupt Controller

**P**ardon the interruption...." While interruptions are considered impolite, sometimes you have to make them, especially in microcomputer systems. Many computers, particularly those involved with real-time or time-sharing applications, require microprocessor interrupts to make proper operation possible.

An interrupt allows an external device to have the processor stop what it's doing and take time to service the external device. If the processor isn't doing something more important (determined by a combination of hardware and software), the processor complies with the interrupt. If the processor is working on something more important (a higher-priority device) it ignores the interrupt request and continues with what it was doing.

Many systems (like the TRS-80 Models I, III and 4), use polling for input/output (I/O) operations to see when you've pressed the keyboard or when it's OK to send a character to the printer. Polling is simply a check to see if a device is ready or needs servicing. In a polling system, the processor continually loops to check the status of various devices. This is fine as long as the processor has nothing else to do. But it can often be doing useful work while waiting on I/O devices. Interrupts allow the I/O devices to interrupt the processor when they need service, permitting it to do useful work in the meantime.

This month's project is an interrupt controller compatible with the Models I, III and 4. The controller board uses an 8259A interrupt controller integrated circuit (IC), which does most

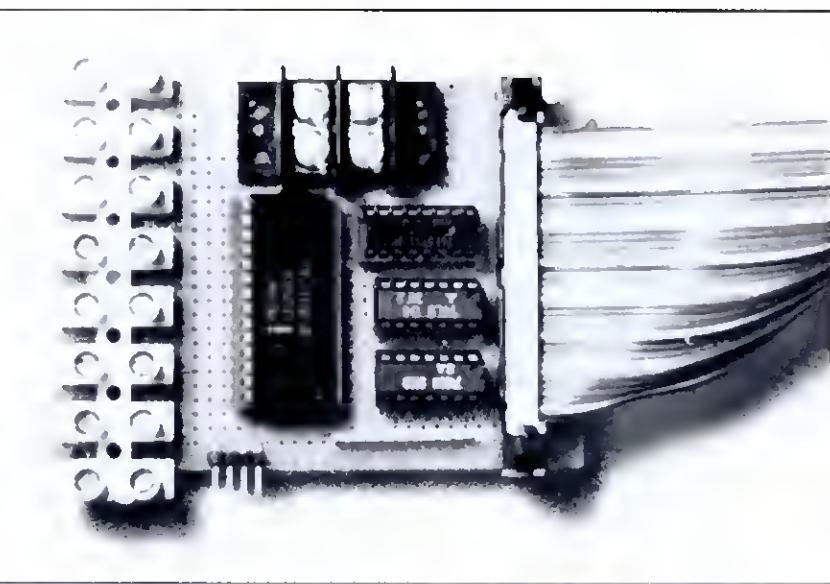


Photo 1. Interrupt controller for Models I, III, and 4.

of the work on the board.

## A Look At Z80 Interrupts

The Z80 has two interrupt input lines (INT/ and NMI/) and uses a combination of two signals to acknowledge an interrupt. The INT/ line is the general-purpose interrupt input, the one most commonly used. The NMI/ line, or nonmaskable interrupt line, is reserved for special emergency situations, such as a power failure.

You can enable or disable (mask) the INT/ line under software control, using the Z80's Enable Interrupt (EI) and Disable Interrupt (DI) instructions. This allows the software to determine when to accept interrupts and when not to. The NMI/ input, on the other hand, is nonmaskable, meaning that you can't disable it with software. Because of this, it's rarely used.

The Z80 has three interrupt modes, mode 0, mode 1 and mode 2, which you can use with the INT/ interrupt input. These modes give the Z80 a considerable amount of interrupt flexibility, allowing effective interrupt use in a variety of system applications. I'll

discuss how the Z80 responds to each of the interrupt modes separately, including the best uses for each one.

## Z80 Mode 0 Interrupts— 8080A-Compatible Mode

Interrupt mode 0 is the default mode on processor reset. The Z80 responds to its interrupt input in the same manner as its predecessor, the 8080A. The Z80 looks at the interrupt input at the end of each instruction. If it's active (low) and interrupts are enabled, the processor stops its execution and begins servicing the interrupt request. The response will vary depending on the interrupt mode you're using.

In the case of mode 0, the Z80 sends an interrupt-acknowledge signal to the interrupting device when it accepts an interrupt. It does this by simultaneously bringing the M1/ and IORQ/ signals low. The interrupt-acknowledge signal acts as a read strobe to the interrupting device, telling it to put the opcode (first byte) of an instruction on the data bus. This is a Call instruction pushing the processor's program

### The Key Box



Models I, III, and 4  
16K RAM  
Assembly Language  
Editor/Assembler

counter (PC) onto the stack and branching the execution to the beginning of the interrupt service routine.

The 8080A (like the Z80) provides a set of 1-byte Call instructions ideal for this purpose. These eight instructions, called Restart instructions, make a call to a predetermined location in memory (usually occupied by ROM). Because of their bit makeup, you can easily generate them with hardware. The instructions to do so, along with the binary code, are shown in Fig. 1, along with the memory addresses to which they call. The underlined bits indicate the only bits that differ among the eight different Restart instructions.

While the Restart instructions are easy to generate and are the most common in 8080A systems, you can put any 8080A instructions (or Z80 instructions for the Z80) on the bus. For greater versatility in where the computer puts the Call Table service routine in memory, interrupt controllers (like the 8259A used in this month's project) are often designed to generate actual 3-byte Call instructions. This way, you could specify an actual 16-bit address in it. For instructions like this, where the number of instruction bytes is greater than one, the CPU will send enough interrupt-acknowledge signals to read in all the bytes necessary.

Mode 0 is primarily used in systems when you want to maintain compatibility with 8080A systems, or when you're using peripherals (such as the 8259A in this month's project) for use with 8080A-type processors. The Z80's flow response to an interrupt in mode zero is shown in Fig. 2.

#### Z80 Mode 1 Interrupts—Restart 38H

This is the simplest and least flexible interrupt mode the Z80 offers. If an interrupt occurs while you're enabling interrupts, the Z80 merely executes a Restart 38H instruction, which is a Call to memory location 0038 hex. The Z80 produces no interrupt-acknowledge signal, and requires no external hardware. You use this mode in small systems, where the interrupt requirements are minimal and the external hardware required for the other Z80 interrupt modes is unnecessary. This is the one most often used by TRS-80s. The Model I uses it with its 25ms interrupt and disk controller interrupts, and the Models III

and 4 don't even provide the interrupt-acknowledge signal on their expansion connectors, necessary for the use of the other interrupt modes.

Figure 3 illustrates the Z80's flow response to a mode 1 interrupt.

#### Z80 Mode 2 Interrupts—Indirect Call

Mode 2 is the most powerful of the Z80 interrupt modes. The Z80 generates an interrupt-acknowledge signal to the interrupting device, and expects a 1-byte vector in response. This vector is actually the low byte of a memory address which, by convention, must be even. The high byte of the address is found in the Z80's Interrupt (I) register, which you must set up with software. The Z80 puts the 2 bytes together to form a 16-bit address in memory, where it then gets the 16-bit address of the interrupt service routine. The I register points to a vector table page in memory, and the input vector byte provides the offset into that table. Since you can program the I register, you can load the vector table virtually anywhere in memory.

Most Z80 peripheral devices support mode 2 interrupts. You can also support it with a little external hardware, in much the same way as mode 0 interrupts. Mode 2 interrupts are used in most Z80 systems that use Z80 peripherals, or that provide the hardware required for the additional flexibility. The Z80's flow response to mode 2 interrupts is shown in Fig. 4.

#### The Z80 Nonmaskable Interrupt

You can't disable the nonmaskable interrupt. This allows top-priority response from the Z80 in case of a system emergency. When the Z80 responds to a nonmaskable interrupt, it executes a Restart 66H instruction, performing a call to memory location 0066 hex. The Z80 also saves the enable/disable status of the INT/ interrupt before it disables the interrupts for NMI/ servicing (described below). The Z80's flow response to a nonmaskable interrupt is shown in Fig. 5.

#### Interrupt Flip-Flops

The Z80 has two internal flip-flops for interrupt enabling and disabling. These flip-flops, designated IFF1 and IFF2, work with each other to provide the interrupt enable/disable flexibility, as well as temporary enable status storage during servicing of nonmask-

able interrupts. On reset, the Z80 clears both IFF1 and IFF2, preventing maskable interrupts (INT/) from being accepted. When it executes an EI instruction, the Z80 sets both flip-flops, allowing it to accept maskable interrupts. The two flip-flops follow each other most of the time.

When a nonmaskable interrupt occurs, the Z80 saves the current state of

Restart Instruction	Bit Pattern	Call Address
RST 00H	11000111	0000H
RST 08H	11001111	0008H
RST 10H	11010111	0010H
RST 18H	11011111	0018H
RST 20H	11100111	0020H
RST 28H	11101111	0028H
RST 30H	11110111	0030H
RST 38H	11111111	0038H

Figure 1. Restart Instructions.

1. Interrupt occurs.
2. Disable further interrupts.
3. Assert acknowledge.
4. Read byte op-code on data bus.
5. More bytes to come? If yes, then 4.
6. Execute instruction received from interrupting device.

Figure 2. Mode 0 interrupt response.

1. Interrupt occurs.
2. Disable further interrupts.
3. Call memory location 0038H.

Figure 3. Mode 1 interrupt response.

1. Interrupt occurs.
2. Disable further interrupts.
3. Assert acknowledge.
4. Get vector on data bus.
5. Combine vector with I-register value to form address of service routine.
6. Get service routine address and call the service routine.

Figure 4. Mode 2 interrupt response.

1. Interrupt response.
2. Maskable interrupt status is saved.
3. Maskable interrupts are disabled.
4. Call location 0066H.
5. Restore maskable interrupt enable status when done.

Figure 5. NMI response.

# PROJECT 80

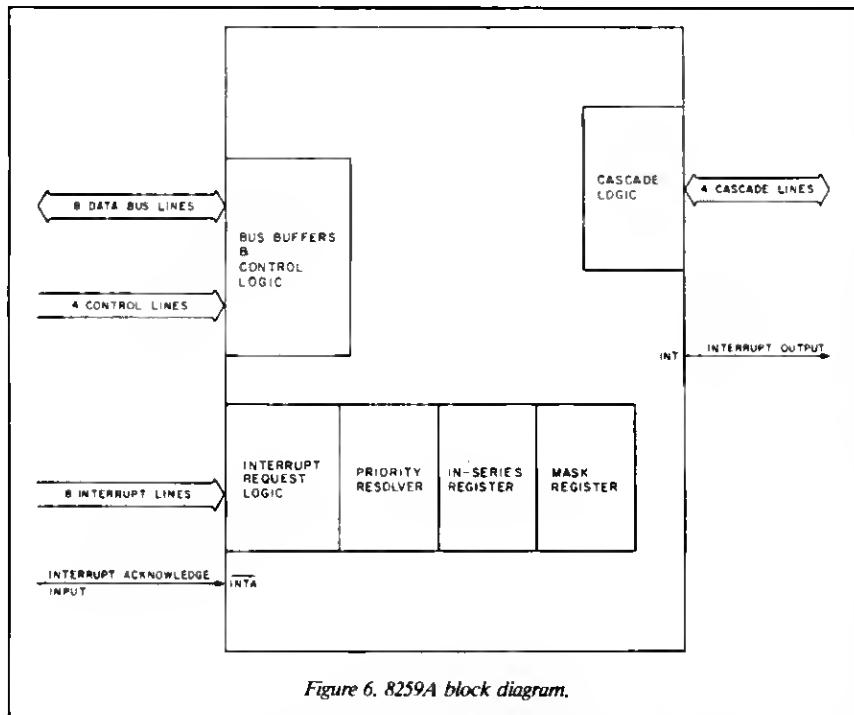


Figure 6. 8259A block diagram.

IFF1 in IFF2, while it clears IFF1 to make sure no maskable interrupts occur while processing the nonmaskable interrupt. When the Z80 executes the RETN (return from nonmaskable interrupt), it transfers the value in IFF2 to IFF1, restoring its original, pre-interrupt value.

### Levels and Edges

Different processors have different ways of determining the validity of an incoming interrupt request. The Z80, for instance, looks for a low level on its INT/ line. When the line is low, the

Z80 assumes that the connected device is requesting an interrupt. Some processors, like the 8085A, look for a high level. When the line is high, the processor assumes that the connected device is requesting an interrupt. Others look for an edge trigger. They expect to see a rising edge or falling edge of a signal for a valid interrupt request. Some even require a combination of an edge and a level.

Each of these triggering modes has its advantages and disadvantages. The level-triggered mode is the most common, and assumes that whenever a de-

vice has its interrupt line at a certain level (either high or low, depending on the processor), it needs servicing. During the service routine, the processor performs whatever operations are necessary for the device to deactivate its interrupt request, before the processor reenables the interrupts.

The edge-triggered mode assumes that a device will activate its interrupt line when it needs service, making the necessary edge trigger, but may not deactivate the line level until some later time. In this case, it is not desirable for the CPU to keep seeing the line as an active interrupt and attempting to service it.

For example, say an interrupt input is positive edge-triggered, meaning that it is triggered by a low-to-high voltage transition. The transition notifies the CPU that a device is requesting an interrupt so the CPU can service the interrupt. At the end of the interrupt service routine (ISR), the CPU reenables interrupts, but the interrupt line is still high. A CPU with a level-triggered input would immediately see the high line as another interrupt request and service the interrupt. The edge-triggered CPU, however, would not recognize another interrupt request until the line returned low, then went high again.

The third type of triggering, a combination of edge- and level-triggering, is often used for nonmaskable interrupt inputs, or in systems with noisy environments. The CPU only checks the interrupt lines between instructions (actually at the end of each instruction). If a low-to-high transition occurs on the line, the CPU sets an internal flip-flop to record the edge. Then, when the time comes to check for an interrupt, the CPU looks for both an active flip-flop, indicating the edge has occurred, and an active (high) input. If both of these conditions are not true, no interrupt service processing will take place.

The advantage of looking for both conditions is two-fold. First, if a glitch (voltage spike) occurs and sets the flip-flop, it will not cause a nonmaskable interrupt, since the line probably won't still be high when the CPU checks it. Second, if a nonmaskable interrupt does occur, the CPU won't recognize another nonmaskable interrupt until the line returns low, then goes high again. The benefits of level-

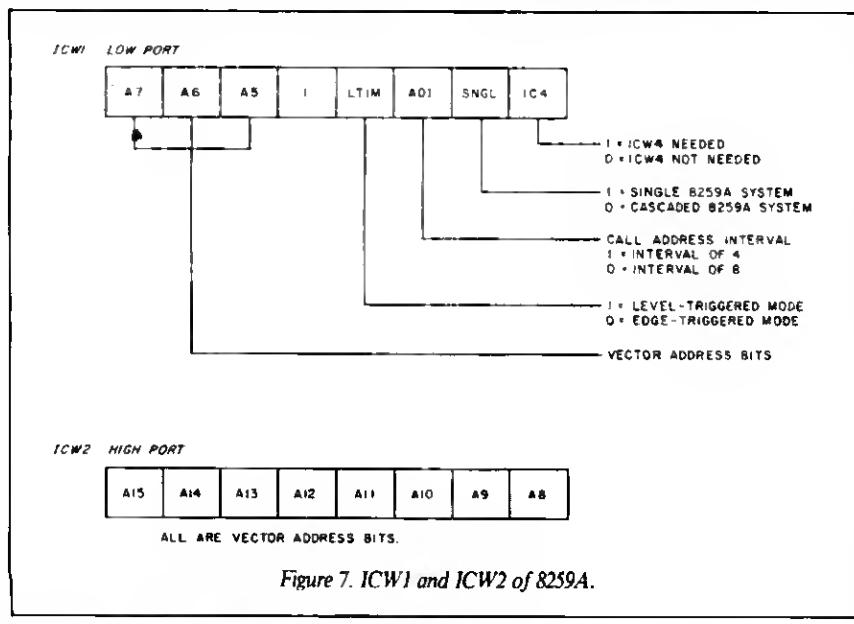


Figure 7. ICW1 and ICW2 of 8259A.

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LPRINT/LPRINT USING	•	•	•	•	•	•
PRINT @	•	•	•	•	•	•
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INPUT #/LINE INPUT #	•	•	•	•	•	•
READ #/READ #/LINE	•	•	•	•	•	•
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FIELD/GET/PUT	•	•	•	•	•	•
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READ/DATA/RESTORE	•	•	•	•	•	•
TRON/TROFF	•	•	•	•	•	•
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DEF USR/SWAP/WAIT	•	•	•	•	•	•
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DEFSTR/DBL/SNG/INT	•	•	•	•	•	•
DOUBLE/REAL	•	•	•	•	•	•
INTEGER/STRING	•	•	•	•	•	•
GOTO/GOSUB	•	•	•	•	•	•
ON ERROR GOTO	•	•	•	•	•	•
RESUME/RESUME NEXT	•	•	•	•	•	•
ERL/ERR	•	•	•	•	•	•
ON number GOTO/GOSUB	•	•	•	•	•	•
NAME/RENAME	•	•	•	•	•	•
PEEK/POKE/INP/OUT	•	•	•	•	•	•
SYSTEM/SOUND	•	•	•	•	•	•
SADO/MATCH/UCASES	•	•	•	•	•	•
VAL/TAB/STRS/VARPTR	•	•	•	•	•	•
SIN/COS/TAN/ATN	•	•	•	•	•	•
LOG/EXP/ABS/SQR	•	•	•	•	•	•
COMMANDS//F ENO	•	•	•	•	•	•
INKEY\$/INPUTS	•	•	•	•	•	•
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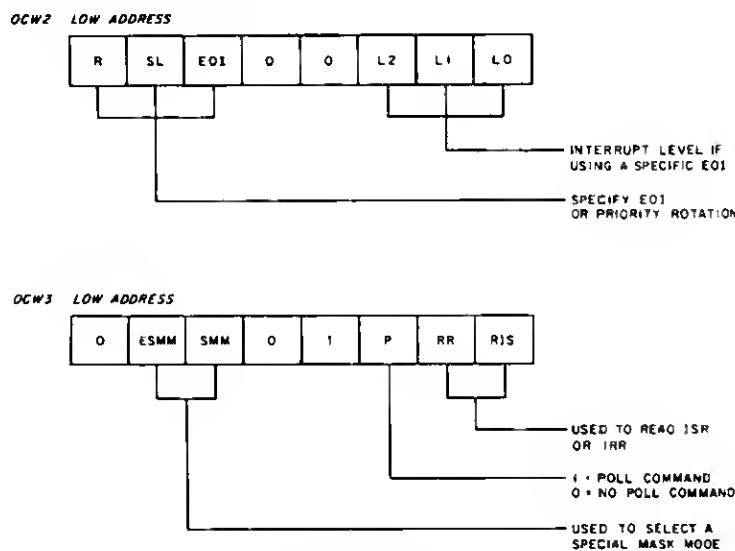


Figure 8. OCW1 and OCW3 of 8259A.

triggering and edge-triggering are combined for a double-safe interrupt input.

## The 8259A Programmable Interrupt Controller

The 8259A programmable interrupt controller (PIC), developed by Intel, is a versatile device that provides eight interrupt inputs and a full 3-byte call to the CPU for versatility in locating the interrupt jump table in memory. The basic block diagram of the 8259A is shown in Fig. 6. An 8-bit bus interface handles communication with the CPU and one interrupt output to the CPU. The 8259A takes up two locations in I/O addressing space.

The 8259A provides several features that make it useful for a variety of applications. The eight interrupt inputs are prioritized, allowing higher-priority devices to interrupt lower-priority devices, but not the other way

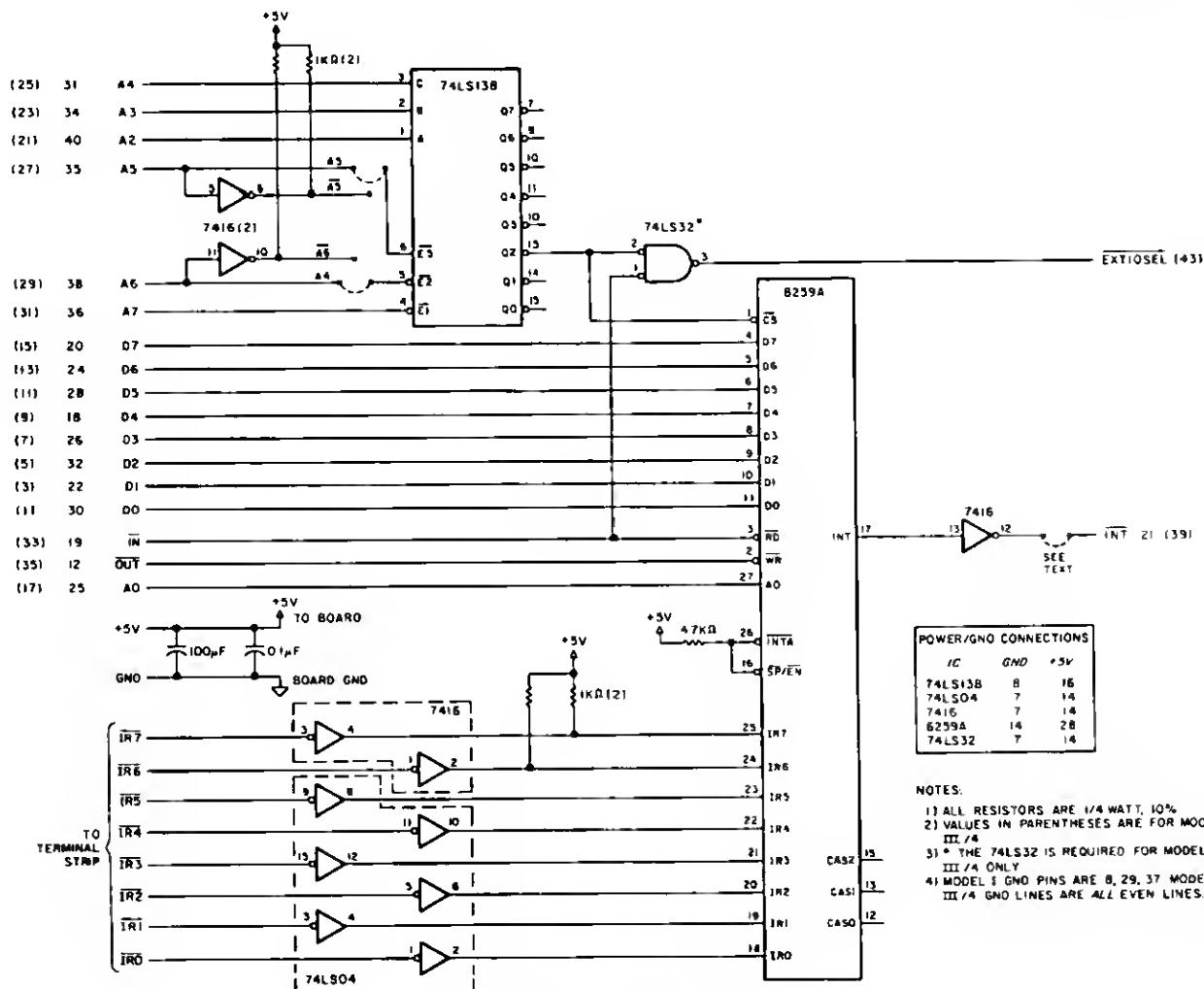


Figure 9. Interrupt controller board.

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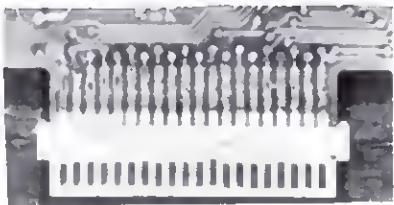
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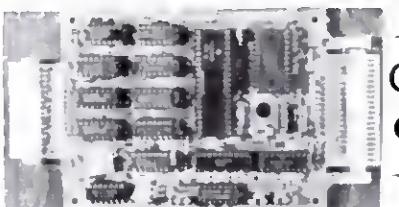
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around. You can program the inputs as level-triggered or edge-triggered, and you can selectively mask (enable or disable) them. You can cascade up to nine 8259A's together, providing up to 64 prioritized interrupt levels.

The CPU can send two kinds of command words to the 8259A: Initialization command words (ICWs) and operation command words (OCWs).

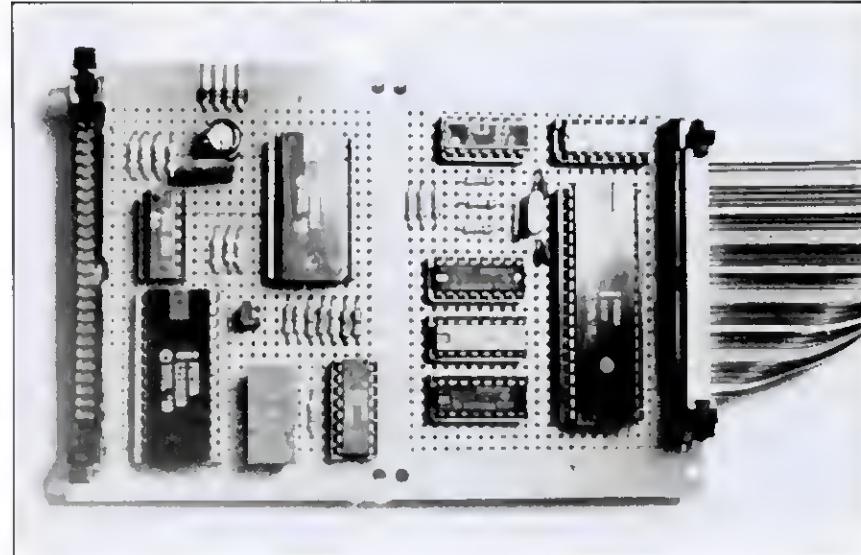


Photo 2. General-purpose I/O board with interrupt controller.

The CPU sends the ICWs only once to initialize the 8259A after power-up. It sends the OCWs at various times as required to perform different operations. OCWs can alter interrupt masks, change priority levels, acknowledge interrupts, and more.

While you have four defined ICWs available, the interrupt controller board will use only two, described here. You'll use all three of the defined OCWs, since they provide the real flexibility in operation.

The interrupt controller is primarily designed to generate a 3-byte call instruction to the CPU when a device requests an interrupt, and the CPU responds with an interrupt acknowledge. Since TRS-80s aren't well-designed for this type of interrupt response (particularly the Models III and 4) you won't use that feature; instead, you'll use its polled mode operation capability.

When you apply power to the 8259A, the state of the device, including its interrupt output line, is unknown, since no reset input is available. Before you use the device, you must initialize it with the ICWs. The two ICWs you'll use are

shown in Fig. 7. While two are shown, you'll use only the first, although you must still send both to the 8259A to meet initialization requirements.

The default mode setting for the 8259A is for 8080A mode, which is what you want. You can also program it to work with the 8086/8088 family of processors. Bit 0 of ICW1 specifies whether or not ICW4 will or won't be

cleared bits enable the corresponding inputs.

The formats for OCW2 and OCW3 are shown in Fig. 8. I'll describe the functions of these operation command words later, when I discuss the operation of the interrupt controller board.

#### Building the Interrupt Controller Board

The parts list for the interrupt controller board (as well as the general-purpose I/O board addition) is shown in Table 1, and the schematic is shown in Fig. 9. Some of the parts are optional, depending on what you actually want to build (described in the remainder of this article). The interrupt controller board is shown in Photo 1. The photo does not include the recommended additional reset circuitry described below.

Building the controller board is simple and straightforward. You need only a few easily obtained ICs, along with a handful of passive components. The addressing for the 8259A is jumper selectable, near the 74LS138. The jumper settings I used are indicated by dotted lines on the schematic (the programs described later will assume this addressing). The possible addressing for the device is as follows:

E2	E3	Addressing Range
A6/	A5/	48-4B hex
A6/	A5	68-6B hex
A6	A5/	08-0B hex
A6	A5	28-2B hex (my choice)

Although the hardware reserves four port locations for each jumper setting, the 8259A requires only two. It is double addressed within the port addressing range. That is, the device will appear in the lower two or upper two locations of the chosen addressing range. The convention for such a situation is to use the lower addresses of the addressing range. I will use addresses 28 hex and 29 hex in the programs described later.

Because the 8259A doesn't have internal reset circuitry, the state of its interrupt output line (pin 17) is unknown at power-up. If this is connected (via the 7416 gate) to the TRS-80 interrupt input line at system power-up, a problem will exist if the interrupt is active. This may not be a problem with the Models III and 4 since they have an internal register to enable ex-

sent. Since ICW4 specifies optional parameters you won't use, this bit is programmed with a zero. Bit 1 distinguishes whether the chip is by itself or if other PICs are cascaded with it. This bit is programmed as a 1 in our system, since it's by itself. Bit 2 relates to the spacing of service routine call addresses in normal operation, and doesn't apply to our system.

Bit 3 of ICW1 determines whether the inputs will look for level-triggered interrupts (1) or edge-triggered interrupts (0). I will use level-triggered interrupts in my examples, but use whatever meets your needs. Bit 4 must be a 1 to indicate that you're sending ICW1. Bits 5-7 of ICW1 and all of ICW2 provide address bits for the call addresses generated during normal operation. These don't apply to your system either.

Once you initialize the 8259A, you can selectively enable or disable the various interrupt inputs by writing a mask byte (OCW1) to the higher 8259A port (port 29 hex on your board). Any bit that is set masks (disables) the corresponding interrupt input, and

## PROJECT 80

ternal interrupts. I presume (though I am not certain) the initialization software in the TRS-80 disables external interrupts, making it necessary for applications software to enable external interrupts before the CPU accepts interrupts. If this is true, the optional reset circuitry described below is unnecessary. In any case, the optional circuitry can't hurt, and I recommend it at least for all Model I users.

The reason the jumper is shown on the schematic (on the interrupt line going to the TRS-80) is in case you don't want to add the optional reset circuitry, or for some reason don't want the interrupt on the TRS-80's interrupt line. You may not need the jumper in your application. You'll also need a +5V @ 150mA (milliamps).

The interrupt inputs to the 8259A have inverters on them. The inputs to these inverters can then be connected to a terminal strip to provide you with eight active low interrupt inputs.

### Building the General-Purpose I/O Board Addition

In December's Project 80, I described the construction of a general-purpose I/O board. An interrupt controller would be a valuable addition, so I've provided the schematic for it (see Fig. 10). The parts list is in Table 1, as it is for the stand-alone interrupt controller board described above. The general-purpose I/O board with the interrupt circuitry is shown in Photo 2.

The construction of this addition is straightforward. You address (chip select) the 8259A from an unused pin on the 74LS138 (pin 13). This gives you the same addressing range as for the stand-alone controller board described above, 28-2B hex. The general-purpose I/O board already has two major peripheral devices, and they're designed to provide interrupts to the CPU during various modes of operation. The five possible interrupt pins (two from the 8255A and three from the 8253/4) are connected to the first five interrupt inputs on the 8259A. This allows selective interrupt inputs under software control.

You could use this, for example, to generate an interrupt to the CPU at predetermined points in time, and update something during the interrupt service routine. I'll illustrate this in the programs described later. This also allows the 8255A to generate interrupts

to the Z80 after certain handshaking operations. (I used the same concept in the printer buffer project described in the September/October 1984 Project 80, p. 102 and p. 146.)

I used five inputs to the 8259A, with three unused. I put inverters at these inputs, to make available three general-purpose active low interrupts.

### The Optional Reset Circuitry

The schematic for the optional reset circuitry is shown in Fig. 11. The parts are listed in Table 1, along with the other project parts. The reset circuitry provides a function available on many peripheral devices, and would probably have been put on the 8259A if an extra pin were available.

The reset circuitry is very simple, and requires the addition of only a 74LS74 dual D-type flip-flop and a 74LS32 quad OR-gate (Models III and 4 users may use spare 74LS32 gates from the EXTIOSEL/ circuitry), and a couple of resistors. The interrupt output that was to go to the TRS-80 INT/ line (pin 12 of the 7416) is routed instead to pin 9 of the 74LS32. The TRS-80 RESET/ output line then goes to pin 1 of the 74LS74, the reset line on the first flip-flop. For this to work, you must turn on the interrupt controller before or simultaneous with the TRS-80, so that it can see the TRS-80's power-up RESET/ signal.

Pins 13 and 12 of the 74LS32 connect to the chip select (CS/) and write (WR/) lines on the 8259A, respectively. This creates an active (low) output signal when both input signals are active (low). This creates the necessary clock input to the 74LS74 when the 8259A is written to.

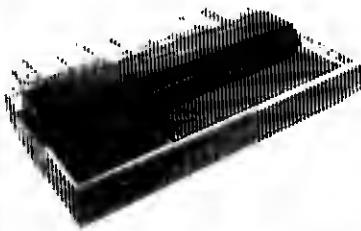
Look at how this circuit works. When you reset the TRS-80, the Q/ (Q not) output of the 74LS74 (pin 6) goes high. This makes the output (pin 8) of the connected OR-gate high, regardless of the other gate input. The second 74LS74 flip-flop is then used as an inverter, to create a low level on its Q (pin 9) output. This then goes to the 7416 gate to get re-inverted to a high level, an inactive interrupt level.

When the computer first writes to the 8259A, however, the clock input (pin 3) to the first flip-flop makes the D-input value (high) appear on the Q output, and the inversion of that to appear on the Q/ output. The low level on Q/ enables the connected 74LS32,

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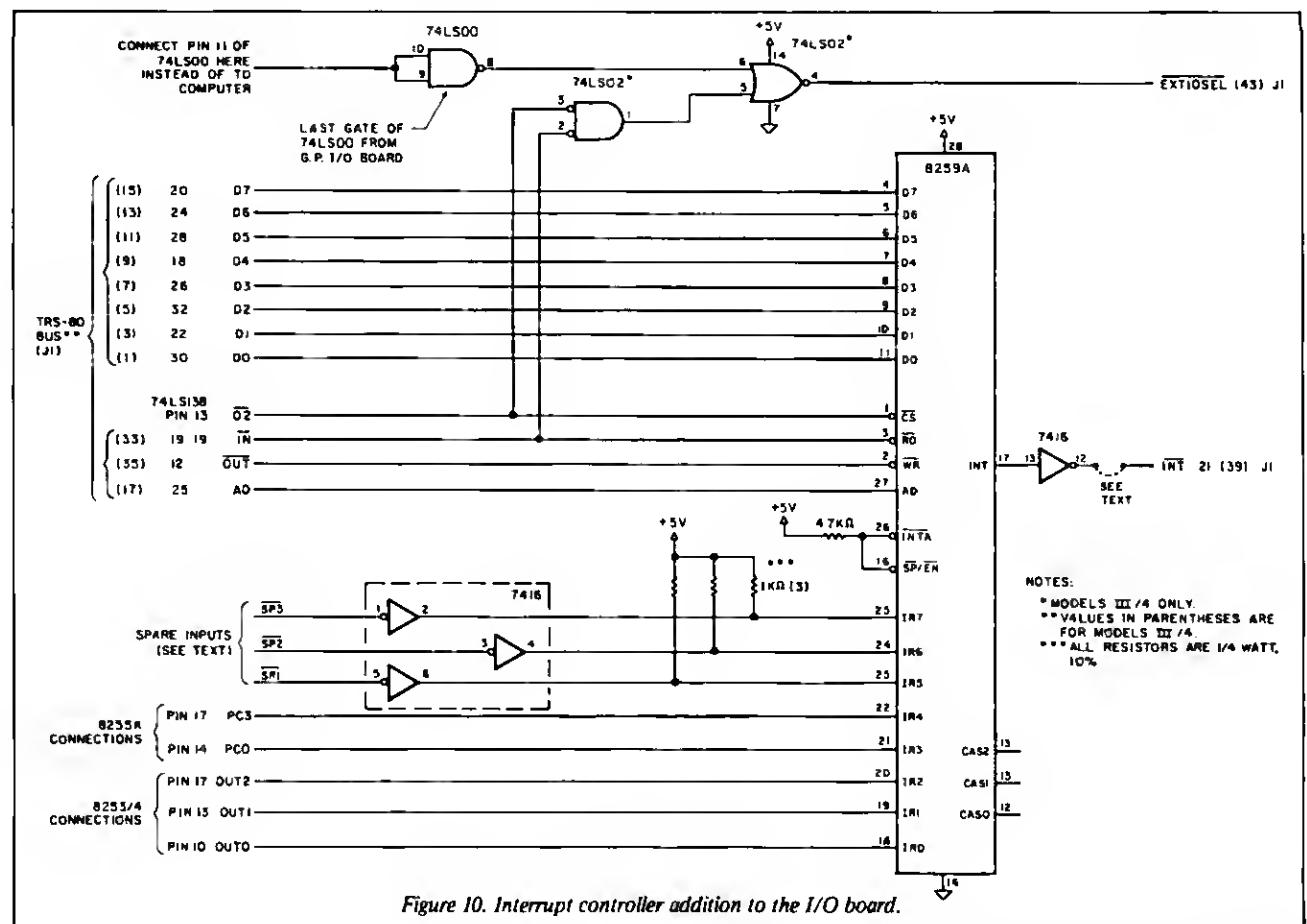


Figure 10. Interrupt controller addition to the I/O board.

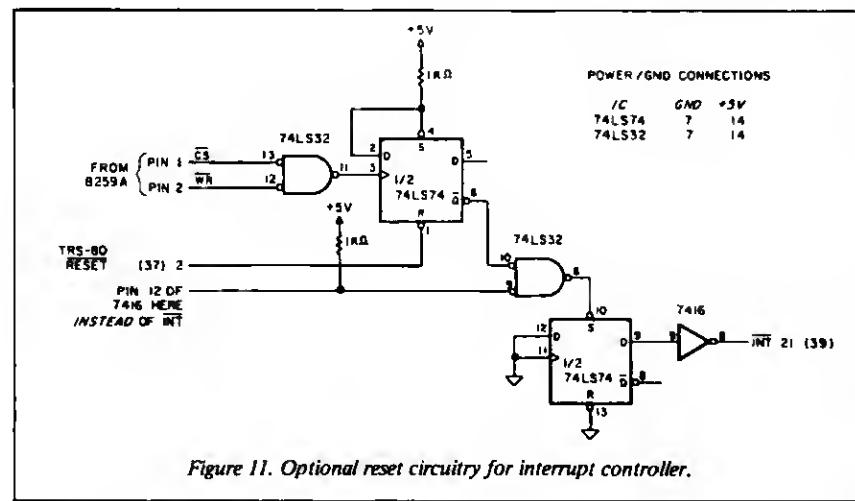


Figure 11. Optional reset circuitry for interrupt controller.

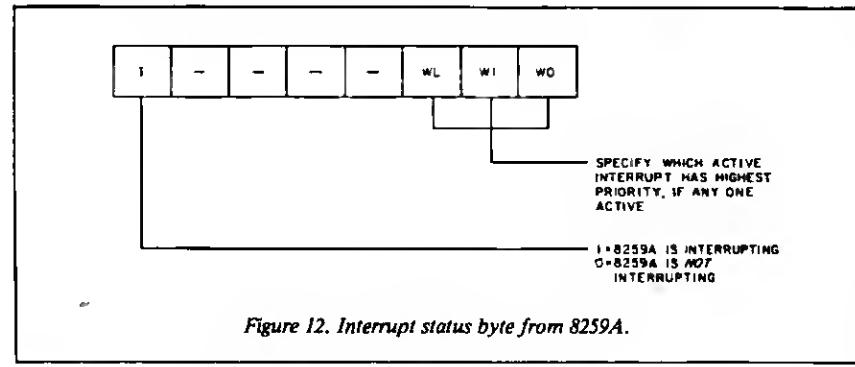


Figure 12. Interrupt status byte from 8259A.

which transfers the interrupt level on its pin 9 input to its pin 8 output, and, after two further inversions, is finally placed on the TRS-80's interrupt line. The interrupt output from the 8259A to the TRS-80's interrupt line will, then, always be enabled until it receives another reset signal. The reason for the double inversion (using the second flip-flop and the 7416) is because of the need to use the open collector 7416 gate, described below.

## Operating the Interrupt Controller

This section concerns both the stand-alone controller board, as well as the general-purpose I/O board addition, since both operate identically. One of the essential requirements of the interface to the Model 1 bus is to use an open collector driver. Open collector drivers, like the 7416 inverting drivers, don't have the collectors on their output transistors pulled up, as do standard transistor-to-transistor logic ICs. This lets you tie any open-collector outputs together with a common pull-up resistor. The net effect is that, when all the outputs are high, the line is high. When any one of them goes

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	LD	B,C
	LD	B,H
	LD	E,H
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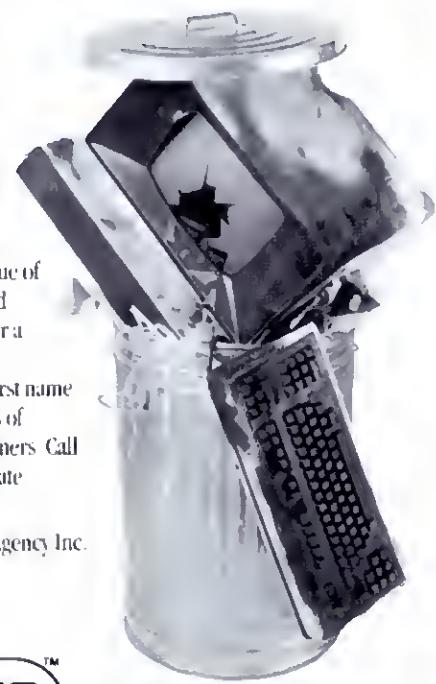
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## PROJECT 80

*Program Listing. Demonstration for Model III/4 to illustrate the use of the 8259A interrupt controller with the December Project 80 general-purpose I/O board.*

low, the line goes low. This is called a wired-OR configuration.

Open collector drivers allow many devices to share the common interrupt line to the CPU. The CPU must, however, have some way to determine what is requesting any given interrupt. While Model 1's require the use of open collector drivers, Models III and 4 users could get by with using a 74LS04 instead of the 7416 chip described above, since open-collector drivers aren't required on the external I/O bus. It is, however, recommended that you use the 7416 because it's a better driver and it lets you parallel other devices that use the interrupt line on the bus in the future. The pull-up for the 7416 is internal to the Models III and 4, as well as to the Model 1.

As mentioned during the discussion of the 8259A, the operation command words let you set up most of the various options the 8259A allows. I've developed a program for the Models III and 4 that illustrates the use of the 8259A (see the Program Listing). The program uses the functions of the general-purpose I/O board, but should give you an understanding of the operation of the interrupt controller even if you only build the stand-alone interrupt controller board.

You first set up the 8259A by sending the two ICWs, as well as the interrupt mask (the port addressing is important to note). The interrupt mask sent to the 8259A is 0FEH, only enabling interrupt input 0, which is the output of Timer 0 on the 8253. The 8255A is then set up to permit control of the programmable divided clock to the 8253, as well as the LED display. The display is initialized with a 0. The original 8255A value is also stored in a memory location (PPIBYT) for later reference (during the ISR). Another memory location (TIMCNT) is also cleared, to be used as a count register.

Timer 0 of the 8253 is now set up to operate in mode 0 (interrupt on terminal count), which causes the output of the timer to initially go low, but then go high when the count reaches zero. The frequency input to Timer 0, as established by the 8255A, is 250 KHz, the slowest possible frequency. Assuming we would like to update the LED display once each second, the interrupt to the CPU must occur at a frequency that will easily multiply to

*Listing continued on p. 162*

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# Getting the Message Across

One of the most important functions of a BBS is its ability to search and find information. Successful BBSes can locate information accurately and efficiently. This month's BBS Express concentrates on finding messages both in memory and on disk.

While it's faster to locate information in memory than on disk, memory space is more limited, which in turn limits the amount of information you can keep in memory. A message header, for example, consists of the message number, subject, date, time, section number, name of sender, and destination. Ideally, all this information should be in memory so you can locate a message quickly. This information requires a total of 92 bytes for each header, or 9.2K of memory if there are 100 messages on board. Unfortunately, however, that's a lot of memory.

To complicate matters further, this header information is in string form, which can easily trigger string garbage collection. The message number, however, isn't in string form. An acceptable solution, then, is to create a fast, in-memory search for the message number, leaving all other searches as disk operations. Because the message numbers are stored economically, memory isn't heavily taxed.

## Storing the Message Number

Your computer's memory stores integers in Z80 least significant byte/most significant byte (LSB/MSB) format. Each integer requires 2 bytes: The first byte contains the least significant byte, while the second byte contains the most significant byte. In message number 256, for example, the least significant byte is 0, and the most significant byte is 1. The VARPTR command returns the address where the BBS stores the least significant byte; it stores the most significant byte in the next position.

Using this information, you build an in-memory index of the message



numbers that you access with a short machine-language code (see Program Listing 1). The index is simply a string that contains the message numbers in sequential order, making it easy to search for any given message number. The VARPTR (string variable) returns the memory address of a pointer that contains both the length of the string and the memory address of the string's first character. Because this information is all part of the same string, it's easily written to disk.

Now you need to convert the message numbers to and from the Z80 LSB/MSB format. Disk Basic does this: It contains MK1\$, which returns a 2-byte string in LSB/MSB format, and CV1, which takes that string and returns a number. In the case of message number 256, MK1\$(256) = CHR\$(0) + CHR\$(1); CV1(CHR\$(0) + CHR\$(1)) = 256. Each time a user leaves a message, the BBS writes MK1\$ (message number) to the in-memory string. The BBS stores the header for the Nth message in record N, and finds it in the index string at position  $2^*N - 1$ . If P is the position in the string, and RN

is the record number of the header for the message, then

$$\begin{aligned} RN &= (P + 1)/2 \\ P &= (2^*RN) - 1 \end{aligned}$$

Program Listing 1, in Assembly language, searches the index for the message number. With this message number, you have access to the header, which gives you the secret file name of the text of the message. Label FSRCH calls the PARAM routine which places the length of the string passed from Basic in the B register, and the address of the string's first character in the HL register pair. Basic POKEs the message number that you're looking for in SEARCH + 1.

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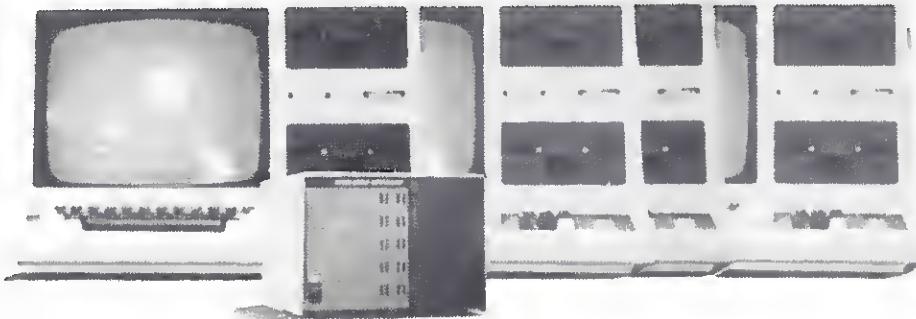
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The BBS then loads this value into the DE pair, transfers the address of the first character in the string to the IX register with the PUSH HL, POP IX instructions, and loads C with 255 to act as a counter.

The BBS loads HL with the value that's located in the first two positions of the string. C is bumped twice, changing its value to 1. Because deleted messages are marked by being set to a negative value (your computer uses 2's complement notation), if bit 7 of the value in the H register is a 1, it's negative and thus ignored as a killed record.

If the number in this position isn't negative, it's compared with the value

*If the message numbers exceed the limit, the BBS removes all deleted messages and text files.*

*Program Listing 1. BBS code that locates message numbers.*

```

01740 ;      SEARCH FORWARD FOR SPECIFIED 2-BYTE STRING
01750 ;
01760 FSRCH CALL  PARAM      ;GET VARPTR(MNS)
01770 SEARCH LD   DE,0008  ;SEARCH STRING
01780 PUSH  HL
01790 POP   IX
01800 LD   C,255   ;STR. POS. COUNTER
01810 FSR010 LD   L,(IX+0)
01820 LD   H,(IX+1) ;GET FIRST PAIR FOR
CMPLR
01830 INC   C
01840 INC   C      ;BUMP STRNG POINTER
01850 BIT   7,H      ;CHECK FOR NEGATIVE
01860 JR   NZ,REVR  ;NEGATIVE - DEAD FILE
01870 RST   1BH      ;COMPARE HL/DE
01880 JR   Z,FSR100 ;FOUND
01890 JR   NC,FSR100 ;TARGET>SOURCE
01900 REVR INC   IX
01910 INC   IX
01920 DEC   B
01930 DJNZ  B
01940 FSR100 INC   C      ;LOOP TIL FOUND
01950 SRL   C      ;STRPOS+1
01960 LD   B,B      ;(STRPOS+1)/2
01970 PUSH  BC
01980 POP   HL
01990 JP   BASIC   ;PASS TO BASIC

```

*End*

*Program Listing 2. BBS code to interface Program Listing 1 with Basic.*

```

430 POKE FD+1, INT(MN/256) :POKE FD,MN-(INT(MN/256)*256) :
S=USR3(VARPTR(MNS)) :RETURN
2730 IF (SN=0) OR (LEN(MNS)=0) THEN SL=0:SH=0:SN=0:NWS="" :
GOTO 2820
2740 FOR S=LEN(MNS)-1 TO 1 STEP -2:MN=CVI(MIDS(MNS,S,2))
2750 IF (LEN(NWS)<2*MX) AND (MN>0) THEN
NWS=MIDS(MNS,S,2)+NWS:PS=CHR$(INT((S+1)/2))+PS:GOTO 2770
2760 AS="MSC0000/BBS"+DDS:GOSUB860:XILL AS:SN=SN-1
2770 NEXT:IF LEN(NWS)>1 THEN SL=CVI(LEFT$(NWS,2)) :
SH=CVI(RIGHT$(NWS,2)):GOSUB220 ELSE SL=0:SH=0:GOTO 2820
2780 FOR P=1 TO SN
2790 GET 1,ASC(MIDS(PS,P,1))
2800 PUT 1,P
2810 NEXT:CLOSE
2820 GOSUB190:GET 3,1:LSET SLS=MKIS(SL):LSET
SH=MKIS(SH):LSET SCS=MKIS(SC+1):LSET
NDS=MKIS(ND):LSET NMS=MKIS(NM):LSET OSS=MKIS(DS):PUT 3,1
2830 FIELD 3,255 AS ZM$:LSET ZM$=NWS:PUT 3,3:CLOSE
2840 RUN

```

*End*

DE register pair from the contents of the HL register pair, ignoring the result yet saving the flag status.

If the RST 18H command sets the zero flag, the BBS has found the message number. But if the Carry flag isn't set, you've gone too far. In either event, the BBS increments the C counter by 1, then divides it by 2 by shifting it one position to the right (SRL C), placing zero in the B register, and moving BC to HL to pass to Basic.

If the message number is still unknown, the BBS bumps IX, to point to the next pair of characters, decrements B, and initiates DJNZ, looping to FSR010 until done. The JP BASIC instruction passes the value in the HL register (the record number that we're seeking) to Basic.

Program Listing 2 shows how Basic interfaces with the code in Program Listing 1. Basic defines FD as the address of SEARCH+1. Line 430 POKEs the LSB of the number that you're searching for into SEARCH+1, and the MSB into SEARCH+2. A call to USR3 returns S equal to either the record number you want or to the next-highest record number.

Lines 2730-2840 make up the close-out routine. This is done first by compressing the number of messages on the board so they don't exceed the maximum set by the sysop. If you're under the limit, write the index back to disk. If, however, the message numbers exceed the limit, the BBS removes all deleted messages and text files. Any excess messages are removed with NWS, a new index string. This new index starts removing messages at the high end of MN\$ until NWS is equal to 2\*MX, the maximum number of messages the sysop allows. Everything below that point gets killed, and NWS is written to disk. ■

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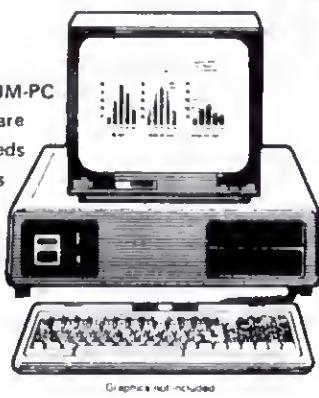
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## Numeric vs. String Arrays

Program Listing 1, Numeric Array, demonstrates how to set an array of numeric variables. It starts with a data statement (line 110) that contains the data the program loads into the array variables. Note the form: I've separated each number in the data statement with a comma.

The dimension statement (DIM) in line 120 creates an array with space for five variables. The program dimensions A to 5 to accommodate the five numbers in line 110.

Line 140 reads the data into array variables A(1)-A(5). To see this, run the program, then print A(1), A(2), and so on.

In Program Listing 2, String Array, the data statement in line 110 contains string data (text) rather than numbers. The strings in a data statement don't need quotation marks, as is necessary when you type in Z\$ = "PLUTO".

Line 115 clears 200 bytes for string storage. The Clear statement must come before the dimension statement. Always clear enough bytes to allow for the string space your program needs for arrays, string variables, and literals.

A string array variable must take the form A\$(X) unless you first estab-



Illustration by John Pirman

lish it as a string with the DEFSTR statement.

## Rules to Remember

A data statement can be as long as your computer accepts (approximately 255 characters). If you run out of space, you can continue a data list on more data statement lines. Basic reads data sequentially, from left to right, from the lowest to the highest line numbers.

You can put data statements anywhere in a program, but you should put them at the beginning of the program for easy reference.

It's not essential that you dimension arrays containing fewer than 11 items, but I recommend including dimension statements for two reasons: You save memory by defining the limits of arrays and it's good programming practice.

The statement DIM A(10) sets up an 11-item array because arrays start with zero. In Listings 1 and 2, Basic sets numeric array A(0) to a zero value and string array A\$(0) to a null value.

In some programs you might not start with A(0) for reasons of consistency. For example, in the String

Array program in Listing 2, it makes sense to have the array subscript correspond to the month it represents. January is the first month, so you should start with A\$(1).

You can assign an array value with subscripts of zero to 10 without dimensioning an array or giving values to other subscripts in the array. For example, the statement A(10)=10.5 is legal, even if the program doesn't dimension, read, or assign values to A(0)-A(9).

You can dimension several arrays with one DIM statement by using the form DIM A(50), B\$(Y), Z1(5). To redimension an array you must precede it with a Clear statement. Failure to do so results in a Redimensioned Array (DD) error.

A Bad Subscript (BS) error results from using subscripts outside the limits of the array. An Out of Data (OD) error occurs when Basic reads a value into an array without sufficient data. (For more information on error messages, refer to Basic Takes, November 1984, p. 158.)

Some programs read data lines more than once. This requires a Re-

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# BASIC TAKES

## Program Listing 1. Numeric Array program.

```
100 REM * NUMERIC ARRAY * LISTING NO. 1 *
110 DATA 10,6,9,23,15
120 DIM A(5)
130 FOR X=1 TO 5
140 READ A(X)
150 NEXT X
160 ENO
```

End

## Program Listing 2. String Array program.

```
100 REM * STRING ARRAY * LISTING NO. 2 *
110 DATA JAN,FEB,MAR,APR,MAY
120 DIM AS(5)
130 FDR X=1 TO 5
140 READ AS(X)
150 NEXT X
160 END
```

End

## Program Listing 3. Template program.

```
100 REM * TEMPLATE * LISTING NO. 3 *
110 DIM A(5)
120 FOR X=1 TO 5
130 REM * THIS LINE MUST BE REPLACED
135 A(X)=X
140 NEXT
150 ENO
```

End

## Program Listing 4. Dimension by Variable program.

```
100 REM* DIMENSIONING BY VARIABLE * LISTING NO. 4
110 CLS
120 INPUT "HOW MANY ITEMS IN ARRAY LIST";X
130 DIM A(X)
140 FOR C=1 TO X
150 PRINT "VALUE NUMBER";C
160 INPUT Z
170 A(C)=Z
180 NEXT C
190 END
```

End

## Program Listing 5. Coin Toss program.

```
100 REM * COIN TOSS * LISTING NO. 5 *
110 DIM P(2)
120 FOR X=1 TO 10
130 T=RND(2)
140 REM * MODEL 100, MAKE ABOVE LINE: 130 T=INT(1+RND(1)*2)
150 P(T)=P(T)+1
160 NEXT X
170 PRINT
180 PRINT "SCORE: HEADS:";P(1); " TAILS:";P(2)
190 END
```

End

## Program Listing 6. Card Dealer Program.

```
100 REM * CARD DEALER * LISTING NO. 6 *
110 CLEAR 500
120 DIM A$(52)
130 RANDOM
140 REM * MODEL 100, MAKE ABOVE LINE: 130 V=VAL(RIGHT$(TINES,2)):FOR T=1 TO V: G=RNO(1): NEXT T
150 B=1
160 S$="CDNS"
170 R$="A23456789TJQX"
```

Listing 6 continued

## Card Dealer uses arrays to simulate dealing a deck of cards.

store statement to set the data pointer back to the first item in the data list and prevent an OD error.

At the location in the program where you want the pointer to move to the start of the first data line, type RESTORE.

In a program with data on lines 110 and 120, you can type in RESTORE 120 to set the data pointer to the start of line 120 (Model 4 only).

## Programming Techniques

Template, in Program Listing 3, demonstrates another way to establish a numeric array. Type in the listing, then type in 130 A(X)=X. This picks up the incremented value of X and passes it to array variable A(X).

Now substitute INPUT "VALUE"; A(X) for line 130. The program waits for you to input a numeric value and press the enter key.

Here's a change for the Models 1 and 1II: 130 A(X)=RND(100). This line provides random input, and is useful in programs that check varied outcomes using the same set of random values.

Dimensioning by Variable, in Program Listing 4, lets you input the dimension of the program array. Line 120 prompts you to set the number of array subscripts. Input 10, and line 130 becomes DIM A(10). The For... Next loop in lines 140-180 lets you set values for A(1)-A(10).

Coin Toss, in Program Listing 5, tests probability against results and shows how array values can change during a program run. P(1) is player 1, who wants heads, and P(2) is player 2, who wants tails.

The For...Next loop in lines 120-160 tosses the coin 10 times. Line 130 generates random output. If it outputs a 1, line 150 increments the P(1) score by 1. If it produces a 2, the program adds 1 to P(2). Line 180 prints the ending scores.

Program Listing 6, Card Dealer, uses arrays to simulate dealing a deck of cards. Line 110 clears 500 bytes. Line 120 reseeds the random number

# BASIC TAKES

generator, and in line 150 B=1 represents the first card in the unshuffled deck.

Line 160 contains the suits: clubs (C), diamonds (D), hearts (H), and spades (S), and line 170 contains the 13 card ranks.

The suit loop (S) starts in line 180 and the rank loop (R) starts in line 190. The four suits and 13 ranks give a total of 52 cards. Line 200 makes the card into the appropriate midstring values of rank (RS) plus suit (SS). Line 210 increments B by 1 to set up creation of the next card.

The random dealing routine is in the For...Next loop in lines 230-290. Line 230 starts the loop from 1-52 to ensure that all cards are dealt. Line 260 checks the array string to see if it's already dealt (equal to a dash). If so, the program returns to line 240 for another random number.

Line 270 prints the card chosen, and line 280 changes the array variable to a dash so the program doesn't pick it up again. The program displays the cards in the order they're dealt. Run Card Dealer again and they appear in a different order. This program is a good foundation for creating a card game program.

## Multiple-Dimension Arrays

So far I've discussed only single-dimension arrays. Array variable A(4,4,4) is an example of a three-dimensional array representing width, height, and depth. Such an array might be useful in representing Rubic's cube (although it assumes the puzzle has internal cubes).

As a demonstration of multiple arrays, Annual Profit/Loss in Program Listing 7 uses a double-dimensioned array to figure year-end profits or losses.

The months given as data in lines 110-120 become the values of B\$(1)—B\$(12) in line 160. The DIM statement in line 140 establishes a numeric array, A(12,2), 26 variables, and a string array, B\$(12).

Note the mix of string and numeric arrays. In A(12,2), the 12 establishes a row for each month, and the 2 establishes columns for monthly income and expense figures.

The For...Next loop in lines 150-170 reads the months into the B\$(X) array. The loop in lines 180-260 prints the name of the month and leads into

*Listing 6 continued*

```
100 FOR S=1 TO 4
190 FOR R=1 TO 13
200 A$(B)=MIDS(R$,R,1)+MIDS(S$,S,1)
210 B=B+1
220 NEXT R,S
230 FOR X=1 TO 52
240 C=RND(52)
258 REM * MODEL 100, CHANGE LINE 240 TO 240 C=INT(1+RND(1)*52)
260 IF A$(C)="-" THEN 240
270 PRINT A$(C); " ";
280 A$(C)="-"
290 NEXT X
300 END
```

*End*

*Program Listing 7. Annual Profit/Loss program.*

```
100 REM* ANNUAL PROFIT/LOSS * LISTING NO. 7 *
110 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY
120 DATA AUGUST,SEPTEMBER,OCTOBER,NOVEMBER,DECEMBER
130 CLS
140 DIM A(12,2), B$(12)
150 FOR B=1 TO 12
160 READ B$(B)
170 NEXT
180 FOR B=1 TO 12
190 PRINT B$(B) " REPORT"
200 PRINT
210 FOR C=1 TO 2
220 IF C=1 THEN INPUT "INCOME";M ELSE INPUT "EXPENSES";M
230 A(B,C)=M
240 NEXT C
250 CLS
260 NEXT B
270 CLS
280 PRINT "PRESS A KEY TO SEE NEXT ENTRY."
290 PRINT "ANNUAL RESULT"
300 PRINT "MONTH",TAB(10); "INCOME",TAB(20); "EXPENSES",TAB(30);
"PROFIT"
310 PRINT STRING$(39,"-")
320 FOR B=1 TO 12
330 T=A(B,1)-A(B,2)
340 PRINT B$(B) TAB(10);A(B,1);TAB(20);A(B,2);TAB(30);T
350 V=V+T
360 Z$=INKEY$
370 IF Z$="" THEN 360
380 NEXT B
390 PRINT TAB(25); "TOTAL";V
400 ENO
```

*End*

a loop within a loop in lines 210-240. If the C equals 1, the program inputs income; if it equals 2, the program inputs expenses.

January's income variable is A(1,1) and its expense variable is A(1,2). The subscripts continue to A(12,1) for income and A(12,2) for expenses for December.

Line 230 makes the array variable worth the value you input for M. (You can combine lines 220-230 by substituting A(B,C) for M in line 230 and deleting line 220.)

The second part of the program prints the results, month by month, as well as the month's profit/loss total. The program obtains the results by subtracting each month's expenses from profits (line 330).

Line 340 displays the information, line 350 increments V by the month's total, and line 390 displays the yearly total.

You can use triple- or even quadruple-dimensional arrays. Multiple-dimensional arrays use up memory, however. A 4-by 4- by 4-dimension array sets aside space for 64 variables.

## Next Month

Next month's topic is streamlining programs. Call it packing, call it crunching, it's all about how to make programs shorter and faster. See you then. ■

*You can reach Richard Ramella at 1493 Mt. View Ave., Chico, CA 95926.*

# Teaching Old Basic New Tricks

One of the most fascinating aspects of computer languages like Lisp, Logo, and Forth is that they aren't completely defined; you can customize them to suit your needs. The longer you use them, the more functions your implementation of the language has. The computer constantly "learns" new commands as you program.

Model I/III Basic, on the other hand, seems set in cement because most of its code, as well as Disk Basic's, is stored in unchangeable ROM. Whenever you type in NEW, RUN, or CLEAR, the computer forgets everything you've done and starts with a clean slate. But Basic really isn't set in cement; you can make changes to it. Several commercial products are available that let you extend TRS-80 Basic with new commands. You can also add your own commands to Basic to make it do whatever you want.

During the next few months, I'll describe ways you can add commands to Basic. This month I'll explain some of the fundamental concepts; in future columns I'll include some specific commands as well as methods for hooking them into the Basic interpreter.

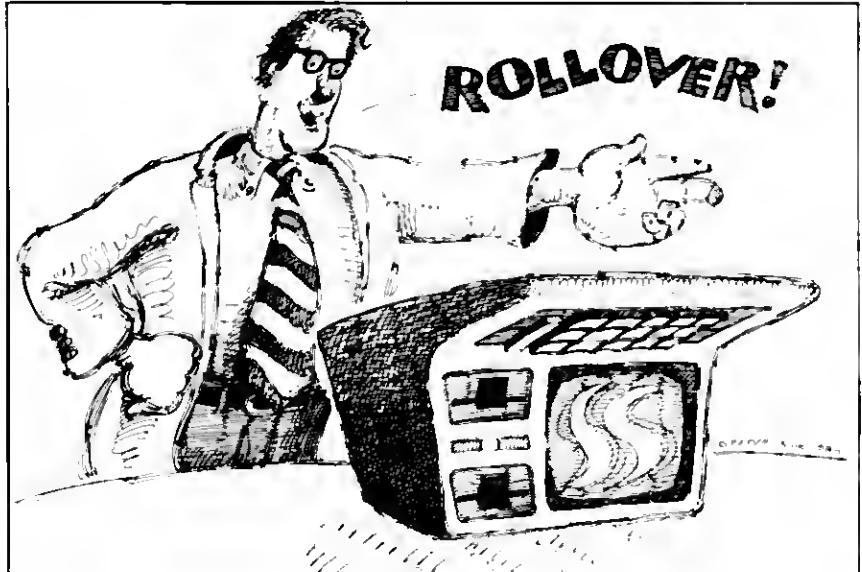


Illustration by Peter Bono

## Basic's Structure

As you'd expect from any large program, the TRS-80's ROM Basic is well-organized. When you run a program, the Basic interpreter begins executing each command with the HL register pointing to the last byte that the computer parsed and executed. The interpreter then skips over spaces, tabs, and line feeds to find the next byte in the program, which it places in

the A register and uses to determine its next action.

Every Basic command is free to use the Z80's registers as necessary as long as it leaves the correct values in HL and AF and restores the stack when finished. Also, the computer executes every Basic command as a subroutine, and each command ends with a RET instruction unless it discovers a program error. You can write your own Model I/III Basic commands as long as they have the structure of a subroutine. In fact, you can do this in several ways.

The real challenge isn't writing new commands, it's finding an appropriate way to hook them into the Basic interpreter. There are four general solutions. You can substitute a new command for a Disk Basic verb, tack one on to the end of a Disk Basic verb as a new syntax form, link one through a DOS exit vector, or (my favorite) hook one into Basic's command interpreter.

## Making the Changes

The Table lists the 3-byte vector addresses for each Disk Basic command

Key Word	Hex Address	Key Word	Hex Address
CVI	4152	FIELD	417C
FN	4155	GET	417F
CVS	4158	PUT	4182
DEF	415B	CLOSE	4185
CVD	415E	LOAD	4188
EOF	4161	MERGE	418B
LOC	4164	NAME	418E
LOF	4167	KILL	4191
MKIS	416A	&	4194
MKSS	416D	LSET	4197
MKDS	4170	RSET	419A
CMD	4173	INSTR	419D
TIMES	4176	SAVE	41A0
OPEN	4179	LINE	41A3

Table. Addresses of the 3-byte vectors for each Disk Basic keyword.

# THE NEXT STEP

and function. When you use Cassette Basic, it loads each vector with a JP instruction to the L3 error routine (the only exception is that the Model III uses TIMES\$).

When you run Disk Basic, it loads each vector with a JP instruction to a routine that supports its command or function. You can replace any Disk Basic verb with a new routine by changing the vector's jump address; if you do so, of course, the original function no longer works.

Program Listing 1 demonstrates this technique; the program turns the Disk Basic Name command into a beep command, and produces a short tone through the cassette port or through the internal speaker of a Model 4 in Model III mode (see line 160 for the change for the Model III mode).

Along with the other listings this month, Listing 1 is an example rather than a working program. The new routine sits in the middle of unprotected memory and bombs if Basic overwrites it. (I'll discuss loading and protecting techniques in a future column.)

You can load Listing 1 from DOS Ready and then enter Disk Basic, or load it once you enter Disk Basic. Then use the DEF USR command shown in the comments to hook the routine to Basic. Whenever the interpreter comes across the command Name, it will produce a beep and then continue normally. Since the new routine doesn't require any parameters, it doesn't have to worry about updating the HL register; it merely maintains the value that Basic put there.

Three problems accompany replacing a Disk Basic command with a new routine. First, unless you're using Cassette Basic, you have to give up a function to get a new one. Second, the name you choose for the routine generally has no relationship to its new function. And third, only a limited number of Disk Basic commands are available; if you want to establish a full set of new commands, you'll quickly run out of possible hooks.

## The Key Box



Model III  
Assembly Language  
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*Program Listing 1. Demonstration showing how to replace Disk Basic verbs by changing the vector's JP address.*

```

00010 ;Demonstration Routine #1
00020 ;
00030 ;Use of the NAME command in Basic will create
00040 ;a "beep" from the cassette port (or Model 4
00050 ;internal speaker). Disconnects the normal
00060 ;NAME command if your Disk Basic uses it.
00070 ;
00080 ;To initialize:
00090 ; Load from DOS Ready, then enter Basic.
00100 ; Type "DEFUSR = 4BA000: A=USR(0)"
00110 ; Then test by typing NAME.
00120 ;
418E 00130 NAME EQU 418EH ;Addr. of NAME vector
00080 00140 TONE EQU 00H ;Change if needed
00080 00150 LENGTH EQU 00H ;Change if needed
00FF 00160 PORT EQU 0FFH ;Use Port 90H for
00170 ; Mod 4 in Model III mode
00180 ; Initialization Section:
A000 00190 ORG 0A000H ;Pick convenient addr
A000 3EC3 00200 BEGIN LD A,0C3H ;Jump instruction in A
A002 210CA0 00210 LD HL,START ;Get routine address
A005 328E41 00220 LD (NAME),A ;Put JP in place
A008 220F41 00230 LD (NAME+1),HL ;Put addr. in place
A008 C9 00240 RET ;Return from USR call
00250 ;
A0260 ; Beep Routine called by NAME:
A08C 1680 00270 START LD D,TONE ;Tone and length
A08E 1E80 00280 LD E,LENGTH ;into DE
A010 0EFF 00290 LD C,PORT ;Output port in C
A012 3E82 00300 LD A,2 ;Toggle sound off
A014 F3 00310 DI ;Interrupts off for tone
00320 ;
A015 3D 00330 SNDON DEC A ;A = 1
A016 ED79 00340 OUT (C),A ;Send it out
A018 42 00350 LD B,D ;Get count
A019 10FE 00360 DJNZ S ;And wait 1/2 cycle
00370 ;
A01B 3C 00380 SNDOFF INC A ;A = 2
A01C ED79 00390 OUT (C),A ;Send it out
A01E 42 00400 LD B,D ;Get count
A01F 10FE 00410 DJNZ S ;And wait 1/2 cycle
00420 ;
A021 1D 00430 DEC E ;Drop length count
A022 20F1 00440 JR NZ,SNDON ;Repeat until done
A024 AF 00450 XOR A ;A = 8
A025 ED79 00460 OUT (C),A ;Turn off cassette port
A027 FB 00470 EI ;Interrupts back on
A028 C9 00480 RET ;Return to interpreter
A000 00490 ;
00500 END BEGIN
00000 TOTAL ERRORS
16670 TEXT AREA BYTES LEFT

```

End

*Program Listing 2. Demonstration showing how to create the simple beep generator as a Disk Basic verb followed by an exclamation point.*

```

00100 ;Demonstration Routine #2
00110 ;
00120 ;Use of CMD! will create a "beep"
00130 ;from the cassette port (or Model 4
00140 ;internal speaker). Does not disturb normal
00150 ;CMD uses.
00160 ;
00170 ;To initialize:
00180 ; Load from DOS Ready, then Enter Basic
00190 ; Type "DEFUSR = 4BA000: A=USR(0)"
00200 ; Test by typing CMD!
00210 ;
4173 00220 CMD EQU 4173H ;Vector addresses
00080 00230 TONE EQU 00H ;Change if needed
00080 00240 LENGTH EQU 00H ;Change if needed
00FF 00250 PORT EQU 0FFH ;Use Port 90H for
00260 ; Mod 4 internal spkr
00270 ;
00280 ; Initialization Section:
A000 00290 ORG 0A000H ;Pick convenient addr.
A000 2A7441 00300 BEGIN LD HL,(CMD+1) ;Get orig. addr.
A003 2215A0 00310 LD (ORIG+1),HL ;Stuff address
A006 210DA0 00320 LD HL,START ;Get new addr.
A009 227441 00330 LD (CMD+1),HL ;Sub ours for orig
A00C C9 00340 RET ;Return from USR
00350 ;
00360 ; Beep Routine called by CMD!
A00D F5 00370 START PUSH AF ;Save status flags
A00E 7E 00380 LD A,(HL) ;Get value
A00F FE21 00390 CP '!' ;Time to beep?
A011 2084 00400 JR Z,YES ;Go if yes
00410 ;
A013 F1 00420 POP AF ;Else recover status
A014 C30000 00430 ORIG JP $-$ ;Go to orig. routine
00440 ;
A017 110000 00450 YES LD DE,TONE<0+LENGTH ;Tone and len. to DE
A01A 0EFF 00460 LD C,PORT ;Port to C
A01C 3E82 00470 LD A,2 ;Toggle sound off

```

Listing 2 continued

# THE NEXT STEP

Listing 2 continued

```

A01E F3    00490    DI          ;Don't interrupt beep
A01F 3D    00500    SNDON    DEC    A          ;A = 1
A020 ED79    00510    OUT      (C),A      ;Send it out
A022 42    00520    LD       B,D      ;Get count
A023 10FE    00530    DJNZ    $          ;Wait 1/2 cycle
A025 3C    00540    ;          ;A = 2
A026 ED79    00550    SNDOFF   INC    A          ;Send it out
A028 42    00560    OUT      (C),A      ;Get count
A029 10FE    00570    LD       B,D      ;Wait 1/2 cycle
A02B 1D    00580    DJNZ    $          ;Drop length count
A02C 20F1    00590    DEC    E          ;Loop until done
A02E AF    00600    JR      NZ,SNDON   ;A = 0
A02F ED79    00610    XOR    A          ;Turn off port
A031 FB    00620    OUT      (C),A      ;Interrupts back on
A032 D1    00630    EI          ;Restore stack
A033 23    00640    POP    DE          ;HL=>Char after "!"
A034 C9    00650    INC    HL          ;Return to interpreter
A035 00660    END    BEGIN
00000 TOTAL ERRORS
16535 TEXT AREA BYTES LEFT

```

End

*It doesn't matter  
which Disk Basic command  
you choose; the idea  
is to create a new  
syntax that would  
normally be impossible.*

Program Listing 3. Demonstration showing how to add a beep function to Disk Basic by interrupting the Basic interpreter as it starts to parse a command.

```

00010 ;Demonstration Routine #3
00020 ;
00030 ;Use of a '!' will create a "beep"
00040 ;from the cassette port (or Model 4
00050 ;internal speaker). Operates by intercepting
00060 ;control from Basic's command interpreter.
00070 ;
00080 ;To initialize:
00090 ; Load from DOS Ready, then enter Basic.
00100 ; Type "DEFUSR = 1H000: A=USR(0)"
00110 ; Test by typing !
00120 ;
4003 00130    INTERP EQU 4003H      ;Interpreter link
00080 00140    TONE EQU 80H      ;Change if needed
00080 00150    LENGTH EQU 80H      ;Change if needed
00FF 00160    PORT EQU 00FH      ;Use Port 90H for
00170 ; Mod 4 internal spkr
00180 ;
00190 ; Initialization Section:
00200    ORG 0A000H      ;Pick convenient addr
A000 00210    BEGIN LD HL,(INTERP+1)  ;Get orig. addr.
A003 221BA0 00220 LD (ORIG+1),HL  ;Stuff into program
A006 21BDA0 00230 LD HL,START  ;Get our address
A009 220440 00240 LD (INTERP+1),HL  ;Sub ours for orig.
A00C C9    00250 RET      ;Return from USR
00260 ;
A00D E3    00270 ; Beep Routine:
00280    START EX (SP),HL      ;Get top of stack
A00E 7D    00290 LD A,L      ;Get lsb of return addr.
A00F EESB 00300 CP 5BH      ; and test it
A011 2003 00310 JR NZ,NO  ;Go if not xx5BH
A013 7C    00320 LD A,H      ;Get msb of return addr.
A014 FE1D 00330 CP 1DH      ; and test it
A016 E3    00340 NO EX (SP),HL  ;Restore stack & HL
A017 C20000 00350 ORIG JP NZ,$-$  ;Go if wrong return addr.
00360 ;
A01A CD781D 00370 CALL 1D78H      ;Get next character
A01D FE21 00380 CP '!'      ;Beep requested?
A01F 2003 00390 JR Z,YES  ;Go if it is
A021 2B    00400 DEC HL      ;Else fix HL
A022 10F3 00410 JR ORIG  ;And leave
00420 ;
00430 ;"!" was found
A024 110000 00440 YES LD DE,TONE<8+LENGTH ;Tone and len. in DE
A027 0EFF 00450 LD C,PORT      ;Port address to C
A029 3E02 00460 LD A,2      ;Toggle for off
A02B F3    00470 DI          ;Don't interrupt beep
00480 ;
A02C 3D    00490 SNDON    DEC A          ;A = 1
A02D ED79    00500 OUT (C),A      ;Send it out
A02F 42    00510 LD B,D      ;Get tone count
A030 10FE    00520 DJNZ $          ;Wait 1/2 cycle
A032 3C    00530 ;          ;A = 2
A033 ED79    00540 SNDOFF   INC A          ;Send it out
A035 42    00550 OUT (C),A      ;Get tone count
A036 10FE    00560 LD B,D      ;Wait 1/2 cycle
A038 1D    00570 DJNZ $          ;Drop length count
A039 20F1    00580 DEC E          ;Loop until done
A03B AF    00590 JR NZ,SNDON   ;A = 0
A03C ED79    00600 XOR A          ;Turn off port
A03E FB    00610 OUT (C),A      ;Interrupts back on
A03F 23    00620 EI          ;Point to char after !
A040 C9    00630 INC HL          ;Return to interpreter
A041 00640 END BEGIN
00000 TOTAL ERRORS
16253 TEXT AREA BYTES LEFT

```

End

Another technique is to add to the syntax of an existing Disk Basic command. It doesn't matter which Disk Basic command you choose, although CMD is the most likely candidate. The idea is to create a new syntax that would normally be impossible.

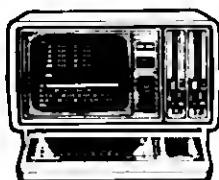
Program Listing 2 shows how you can create the simple beep generator as "CMD!" (or almost any other Disk Basic verb followed by an exclamation mark). However, this technique only works if you pick a Basic command normally used as the first or the only command in a Basic function. Don't try to use commands like INSTR that can only occur after an equals sign.

Written this way, the new command is essentially a filter. When the program invokes the Disk Basic verb associated with the command, it checks to see if the next character(s) is part of the new syntax. If not, control passes to the regular routine for that Basic verb. If you're invoking the new routine, it performs its operations, sets HL properly, and uses a Return instruction to get back to the normal flow of Basic.

Listings 1 and 2 differ in two important ways. First, the initialization section of Listing 2 doesn't destroy the original address in the CMD vector; instead, the program saves that address (at ORIG + 1 in line 430) so that it can jump to DOS's CMD routine when a command other than "CMD!" is interrupted.

Second, the body of the beep routine starts by saving the AF registers on the stack (line 370). Before the interpreter calls a Basic command, the computer processes the character following the command token (the 1-byte representation of the command verb). Basic points the HL register to that next byte, then sets the status flags to indicate whether the byte is a colon (Z

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flag set), numeric (C flag set) or neither (NZ and NC set).

Many routines start by examining the flags as a first check for correct syntax. If the flags were not correctly restored in line 420, the normal CMD processor would likely report a syntax or type mismatch error.

Program Listing 3 shows a third way to add a beep function to Disk Basic. The program works by interrupting the Basic interpreter as it starts to parse a command. If it finds your special command, the program executes it; otherwise control passes to the normal Basic interpreter.

Basic begins parsing and executing each command in ROM at 1D5A hex-adecimal (hex) with an RST 10H instruction. From 0010 hex, the program sends control to RAM location 4003 hex. If you're using Cassette Basic, TRSDOS, or NEWDOS80, 4003 hex contains the instruction JP 1D78H, which sends control to a routine that finds the next character in the program, and adjusts HL to point to it (LDOS, DOSPLUS, MULTIDOS, and the Stringy Floppy system use a different jump at 4003 hex to perform some special instructions).

Listing 3 interrupts the normal flow of control at 4003 hex. First, starting in line 370, it tests the return address on the stack to be sure that this RST 10 hex call came from 1D5A hex. If the return address isn't 1D5B hex, the program gets out of the way by jumping to the original address stored at 4003 hex.

### *Basic changes keyboard symbols to a form completely different from their ASCII codes.*

If the address on the top of the stack was correct, Listing 3 calls 1D78 hex to find the next valid character and checks to determine if it's an exclamation point. If not, the program decrements the HL register once to point to the previous byte and again control passes to the original address (lines 460-500).

Finally, if the program finds the correct return address, and if the next input character is an exclamation point, the program produces a beep. It ends by pointing HL to the next position after the exclamation point and then returning to the Basic interpreter. You must end the routine with HL and the stack set correctly, and with the Z flag set (line 700).

If you want to experiment with this final technique, select new command names carefully. Unless your program carefully checks each name, you must make sure that each new command starts with a character that could not normally appear at the beginning of a Basic command. If, for example, you chose a command A, you could never use a variable that started with the letter A without generating a syntax error.

Also, Basic changes keyboard symbols (such as the arithmetic operators) to a tokenized form completely different from their ASCII codes. If you use one of those symbols as your command name, your program will have to check for the tokenized form.

### Coming Up

Next month, I'll discuss another technique for adding new commands to Basic, and start to develop a program that lets you add many new Basic commands in a single program.

Remember that if you write to me and want a reply, you must enclose a stamped, self-addressed envelope. I am happy to try to answer your questions about Assembly language or use of your Model I, III, or 4. However, because of the amount of mail I receive, I cannot respond if you don't include a stamped envelope. In any case, I always welcome your comments, questions, and suggestions. ■

*Readers who subscribe to ComputerServe can ask questions or take part in discussions on topics covered by "The Next Step." Go PCS-117 to the Writers' and Editors' Special Interest Group (WESIG) and leave your questions or comments addressed to Hardin Brothers. Feel free to join in conversations started by others.*

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# A Rematch Between Two Data Base Systems

I'll devote part of this column to clearing up a problem of transferring graphics-based software between the Model I/III and the Tandy 2000. I'll also revisit an earlier topic: my comparison of Profile III+ to dBase II.

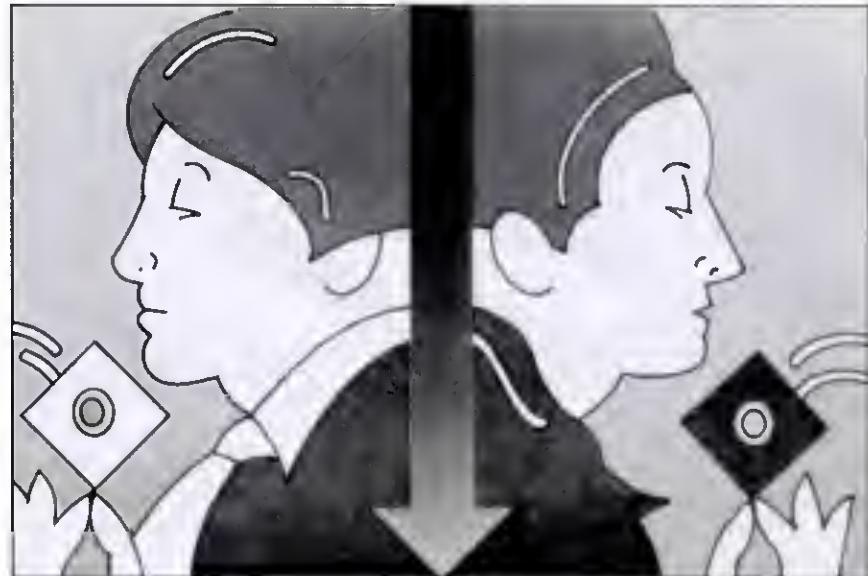
## Customized Graphics

Now that you have a tool for converting Model I/III Basic software to run on the Tandy 2000 (see October 1984, p. 178), you may have encountered another problem: Some programs won't convert because they use Model I/III-specific graphics. Paul Opitz's CHAREDIT program in the final issue of the *TRS-80 Microcomputer News* (volume 6, issue 6) solves the problem by letting you customize the Model 2000 character set.

While using Opitz's program to design a complete Russian alphabet, I realized that I could also replicate the Model I/III graphics character set on the Model 2000. The set I created replaces Model 2000 characters 128-191 with the appropriate Model I/III graphics characters. That allowed me to convert many of my Basic programs without any reprogramming. Unfortunately, this method doesn't work with programs that depend on the Set, Reset, and Point commands to display graphics.

The Program Listing (p. 149) supplies Basic subroutines that duplicate the Model I/III's Set, Reset, and Point functions on the 2000. With these subroutines saved to disk in ASCII format, it's a relatively simple (albeit tedious) task to change Model I/III graphics commands to linkages for these subroutines. I recommend editing the ASCII text of the program with a capable word processor.

The GRINIT routine is the heart of the program. It loads the Model I/III graphics character set modified by CHAREDIT and sets up the byte masks for later use. The next three routines are all very similar; they share



much of the same code. I chose not to put this code in one more subroutine because another function call would have slowed the program down too much. To increase speed, remove all comments and any extraneous blanks, combining as many statements on one line as possible. Table 1 lists the program's variables. The Figure uses a typical character cell divided into graphics pixels to illustrate the variables and their use.

If you'd like the character set editor (CHAREDIT and FONTINIT), the character sets (Russian and Model I/III graphics), and/or the graphics routines in the Listing, send a disk and a self-addressed mailer to me at 1519-A Carswell Circle, Bolling Air Force Base, Washington, DC 20336. Make sure the mailer has correct return postage. For the character set editor, specify the type of display you're using (monochrome/color, graphics/no graphics).

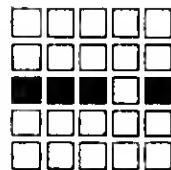
## Battle of the Data Bases—Round Two

In my first column (August 1984, p. 177), I illustrated dBase II's versatility

by comparing its major features to those of Profile III+. I must admit that this was unfair; comparing programs that run under different operating environments is never really fair. However, the Small Computer Co. called my attention to a very powerful extension to the Profile III+ system called filePro-16 (see Table 2). FilePro-16 is available for the Model 2000 and is a single-user, feature-for-

Column	Number
0	R o w
1	N u m b e r
2	

Figure. Screen coordinate algorithm.



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**PERRY COMPUTERS** 137 N. MAIN, PERRY, MI. 48872

feature adaptation of the multiuser Profile-16 system currently available for the Model 16.

FilePro-16 contains an extensive reference manual, program disks, an installation manual, and a start-up manual with a beginner's and an advanced tutorial. The system is huge. Hard disk Model 2000 users will generally have no problem with the program's size, but floppy users will be dismayed at having to use separate creation and runtime disks, as with Profile III+. Remember, Model 2000 disks hold four times as much as Model III disks, but filePro-16's code still doesn't fit on the two program disks—the special character print codes are on another disk.

FilePro-16 is a superior product. The limitations of Profile III+ have been corrected. For example, you can add data and lengthen or shorten any data base file easily. It automatically updates indexes once you define them. You can also build very powerful menus that let you structure applications for easy use by someone unfamiliar with the filePro-16 commands.

FilePro-16's added features are very capable: the ability to spread files over several disks, flexible and numerous input/output format features, and excellent precision in math calculations. FilePro-16 allows over 16 million records per file, and 4,608 characters per record.

With all of these exceptional features in mind, I'll reconsider my original comparison of data base management systems, this time pitting dBASE II against filePro-16. In each of the areas mentioned above, filePro-16 exceeds dBASE II's specifications or provides an easier way to perform an operation. Why, then, is there so much demand for dBASE II? First, it's essentially universal, providing identical capabilities to any computer that runs CP/M or MS-DOS. Don't discount this feature; it's a most important consideration when you have access to multiple computers.

Probably more important, dBASE II, while providing all the data base management functions most people need, is really more of a programming environment than a DBMS. This product's great success derives from its superb flexibility in developing applications. An entire software sub-industry is based on dBASE programming.

Variable	Description
ZX	Specifies the horizontal location of the graphics pixel (0-159)
ZY	Specifies the vertical location of the graphics pixel (0-71)
CX	Character location within the selected row containing the pixel (1-80). This is the integer quotient of ZX/2.
CY	Character location within the selected column containing the pixel (0-24). This is the integer quotient of ZY/3.
CL	Selects the graphics column by examining the remainder from the calculation of CX.
RW	Selects the graphics row number by examining the remainder from the calculation of CY.
BT	Specifies the bit number within the byte for the action to be performed. This value ranges from 0 to 5 and is used to select the appropriate mask from either the SM() or RM() arrays.
CH	Contains the value of the character located in the screen memory at the location specified by CX and CY.

Table 1. Variables used in the Program Listing.

Since these two systems cost the same, I must recommend dBase II as the DBMS system of choice because of its greater wealth of support and portability of data and applications. However, if you also use Profile-16 on the Model 16 computer, you may find filePro more appropriate. These two products are virtually identical and provide unparalleled compatibility. Were filePro-16 less expensive, I'd heartily recommend it for use on the Model 2000.

#### Making dBASE II Better

While I'm on the subject of dBase, I must mention two superior products that I've encountered: DB/RA and dBRx, powerful extensions that overcome some of dBase II's data handling limitations. Although designed specifically for the IBM PC, both run fine on the Tandy 2000.

DB/RA adds the power of one-, two-, or three-dimensional arrays to dBase-II. You can use these arrays with character, logical, or numeric data just as you'd use any other memory variable. In fact, this software extends the number of memory variables available from 64 to over 65,000. A simple statement beginning with the key word Call performs these functions. DB/RA incorporates its own syntax analyzer so these special call statements resemble familiar dBase commands.

dBRx is a math and string extension package making several transcendental functions (sine, cosine, logarithmic, etc.) available for use in data computations. This means you can do most complex calculations within the

dBase II Data Base Manager  
Tandy/Radio Shack  
One Tandy Center  
Fort Worth, TX 76102  
26-5352  
\$495

filePro-16 Data Base Management System  
The Small Computer Company, Inc.  
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dBRx—The dBase II Math/Stat Program  
dB/RA—The dBase II Array Program  
Gryphon Microproducts  
P. O. Box 6543  
Silver Spring, MD 20906  
dBRx; \$150  
dB/RA; \$200

Table 2. Model 2000 product index.

DBMS. The package also supplies three string functions (Pack, BTRIM, and NOSPACE) that enhance the appearance of text data when you display it or print it out. Pack compresses multiple blanks into one, BTRIM trims blanks from the left side of a character string (as opposed to the normal Trim function for removing blanks from the right side), and NOSPACE removes all spaces from the text string. ■

You can reach John B. Harrell III c/o this column, 80 Micro, 80 Pine St., Peterborough, NH 03458, or via CompuServe at 73016, 1326.

## Program Listing. Graphics conversion routines.

```

8810 : ****
8811 :      GRINIT - set up values for the Model-III graphics routines
8812 :
8813 :      No parameters are expected and the values returned are in the
8814 :      arrays SM() and RM() used by the graphics routines.
8815 :
8816 :      GRINIT should only be called once per program execution or an
8817 :      error will occur when attempting to redimension the arrays.
8818 :
8819 :      It may also be necessary to reposition your DATA statements
8820 :      to prevent conflict with GRINIT.
8910 :
8920 : ****
9000 DIM SM(5),RM(5)           'set up proper location for DATA read
9010 RESTORE 9000
9020 FOR I=0 TO 5
9030   READ SM(I),RM(I)         'read the data masks
9040 NEXT I
9045 LOAD "mdialect"          'load the graphics character set
9050 RETURN
9060 DATA 1,254
9070 DATA 2,253
9080 DATA 4,251
9090 DATA 8,247
9100 DATA 16,239
9110 DATA 32,223
9910 : ****
9911 :      SET a graphics pixel using Model-III graphics
9912 :      call by setting ZX and ZY to the location of the pixel
9913 :      and execute using a GOSUB
9914 :      ZX must be in the range of 0 to 159
9915 :      ZY must be in the range of 0 to 71
9916 :
9917 :      This subroutine requires initialization by calling GRINIT
9918 :
9919 : ****
10000 CX = INT(ZX/2) + 1: CL = ZX AND 1      ' calculate col (cx) and gr col
10010 CY = INT(ZY/3) + 1: RW = ZY - 3 * (CY-1) ' calculate row and gr row
10020 BT = RM + RW + CL                      ' bit position within the gr
byte
10030 CH = SCREEN(CY,CX)                      ' get char at current screen pos
10040 IF CH < 128 OR CH > 191 THEN CH = 128  ' if not graphics -- make blank
10050 CB = CH OR SM(BT)                      ' set proper bit to turn on
10060 LOCATE CY,CX: PRINT CHR$(CH);           ' locate and replace screen char
10070 RETURN
10080 : ****
10090 :      RESET a graphics pixel using Model-III graphics
10100 :      call by setting ZX and ZY to the location of the pixel
10110 :      and execute using a GOSUB
10120 :      ZX must be in the range of 0 to 159
10130 :      ZY must be in the range of 0 to 71
10140 :
10150 :      This subroutine requires initialization by calling GRINIT
10160 :
10170 : ****
20000 CX = INT(ZX/2) + 1: CL = ZX AND 1      ' calculate col (cx) and gr col
20010 CY = INT(ZY/3) + 1: RW = ZY - 3 * (CY-1) ' calculate row and gr row
20020 BT = RM + RW + CL                      ' bit position within the gr
byte
20030 CH = SCREEN(CY,CX)                      ' get char at current screen pos
20040 IF CH < 128 OR CH > 191 THEN CH = 128  ' if not graphics -- make blank
20050 CB = CH AND RM(BT)                      ' set proper bit to turn on
20060 LOCATE CY,CX: PRINT CHR$(CH);           ' locate and replace screen char
20070 RETURN
20080 : ****
20090 :      TEST a graphics pixel using Model-III graphics
20100 :      call by setting ZX and ZY to the location of the pixel
20110 :
20120 :      and execute using a GOSUB
20130 :      ZX must be in the range of 0 to 159
20140 :      ZY must be in the range of 0 to 71
20150 :
20160 :      This subroutine requires initialization by calling GRINIT
20170 :      The function return value is returned in variable ZI:
20180 :      ZI = -1 (TRUE) -- the pixel is currently set
20190 :      ZI = 0 (FALSE) -- the pixel is currently reset
20200 :
20210 : ****
30000 CX = INT(ZX/2) + 1: CL = ZX AND 1      ' calculate col (cx) and gr col
30010 CY = INT(ZY/3) + 1: RW = ZY - 3 * (CY-1) ' calculate row and gr row
30020 BT = RM + RW + CL                      ' bit position within the gr
byte
30030 CH = SCREEN(CY,CX)                      ' get char at current screen pos
30040 IF CH < 128 OR CH > 191 THEN CH = 128  ' if not graphics -- make blank
30050 CB = CH AND RM(BT)                      ' set proper bit to turn on
30060 ZI = (CH > 0)                           ' check if bit is set and return
30070 RETURN

```

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Continued from p. 39

menu is Make Basic Lines, which takes everything already entered (saved in a collection of disk files) and pulls it all together into a single, functioning Basic program. You must answer a few prompts, but the process is nearly automatic. The resulting program contains enough comments so that most people familiar with Basic can modify any of it they choose.

But you aren't finished yet. The Producer has created a program whereby you can input data, store it on disk, and edit it at will. But the report structures need to be defined to make that data useful. Once again there is a menu option, Build Reports, that does most of the work.

While the report generator is flexible, it isn't as impressive as the rest of the package. You select which fields of each record to print and in what order. Also, for each report, you can predefine a range of records used to generate the report, or define prompts so the user can make the selections. You can also define a report to create mailing labels.

The Producer lets you define up to nine different report forms for each data-handling program. The different reports will appear on a menu available to the user of the final program.

#### The Freeform Report Generator

The format of the reports generated is limited unless you use the Freeform Report Generator (available with the enhanced Producer package). This program is the best part of the entire package. It lets you use a variety of report formats, complete with extra calculations, subtotal fields, and grand totals. You can even combine information developed with two or more Producer-generated programs if you have some Basic programming skill.

While the Freeform Report Generator is the most complex part of The Producer, it's difficult to imagine any data base report it couldn't generate. But, the Basic programs it does create are the only part of the package that operate more slowly than I would like.

When you're finished developing both the data-entry programs and the final report forms (which you can add to or modify at any time), you're ready to put all of it together in a Basic program. The last selection from the

main menu is Build Program. After answering a few simple questions, The Producer does all the work for you. You can run the final product either under the tiny DOS supplied or transfer it to a DOS of your choice. You could also compile the program with Microsoft's Bascom, though I haven't tried it.

No matter how complex your program development, the finished product is easy to use. It opens with a combination logo/menu page (you can create your own logo if you want) from which you can enter new data for the data base, edit data previously entered, reorganize the structure of a data base for faster access, perform global search and replace operations on your data, go to a report menu, or exit from the program. All of the standard operations are easy to perform.

#### Weaknesses

The Producer does have a few weaknesses. First, when defining the record form for the data base, you're limited to information you can fit on a single screen. You can define a total of 32 fields, and the total possible length of each record is limited to 251 bytes. The Producer uses variable-length random-access records to store information, and needs 5 bytes of each record for its binary-tree organization. If you want to use The Producer on NEWDOS80, which allows records longer than 256 bytes, you can alter a Producer program to increase record size, but I haven't yet needed to try.

The system uses a special form of Trashman to speed up string handling and avoid long garbage collection pauses. In general, everything (except reports created with the Freeform Generator) runs fast enough so that all the disadvantages of Basic seem to have been avoided.

The Producer expects that you will want to enter all the string data in uppercase. You can use mixed case easily while creating a program, but only with some unnecessary difficulty in the final program. Such a restriction would make sense on a Model I, but not on a Model III.

The Producer's documentation says that a technical manual was to be available by early 1984, but when I called about it, I was told that no one had even started to write it yet. A quarterly newsletter, as well as techni-

cal help by phone, is available to registered owners.

Overall, The Producer is an excellent package. I've used it to create three separate and very different types of data bases and found it capable of doing everything I wanted it to. If you are looking for a flexible data base manager, seriously consider The Producer. ■

#### CompuServe on \$5 a Day

by Gary A. Shade

**H**ow to Get the Most Out of CompuServe is one of the best books I've read. It not only covers the major areas of this mammoth consumer information service in an easy-to-read manner, but it can save you money. It was a pleasure to read, which is something I can't say about most computer-related books.

Information services like CompuServe are the fastest-growing segments of the telecommunications industry. All services of this type charge for the amount of time you go on-line. Many people (myself included) have found this to be costly, especially when you're first learning to use the system. Charles Bowen and David Peyton recognized the shortcomings of CompuServe's documentation. This book will eliminate your fear and apprehension, and ultimately save you money in connect charges.

The 277-page book is arranged in lessons, each dealing with a different

#### How to Get the Most Out of CompuServe



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aspect of the system. You start with the basics: logging on, changing your password, and configuring your system. Each excursion you make on CompuServe builds on what you learned in the previous lesson, giving you the knowledge and confidence to explore further.

The authors state that using the lessons will amount to approximately \$36 worth of on-line time, according to current CompuServe rates. But they demonstrate so many shortcuts and advanced features that the charges seem trivial. Even if you plan on only being an occasional user, the \$36 is still a wise investment.

Bowen and Peyton discuss and access every phase of CompuServe within the lessons, from retrieving the weather forecast for your area to using the bland but popular CB simulator. The lessons include the commands necessary to efficiently use each service. Many of the tips have already cut my on-line time and costs.

#### Full Coverage

Both authors have been sysops (system operators) for various CompuServe special-interest groups (SIGs), so they know their way around the system. They even take you on a tour of The Good Earth SIG (HOM-145), of which Dave Peyton is the sysop.

A trip to the new Compu-U-Store is one of the topics discussed in Chapter 14. A consumer can search the store for an item (over 50,000 are stocked) and order it through this service, which offers goods at a discount. While there is a membership fee for using the Compu-U-Store, the authors walk you through by using the free demonstration.

Other topics and lessons include banking by computer, the electronic mall, financial services, and how to buy software through CompuServe. The reader is shown how to prepare an electronic message through e-mail (electronic mail) and how to post it. Similarly, the authors show how to leave a message on the national bulletin board, which all CompuServe subscribers can access and read.

Advanced lessons demonstrate how to turn off the CompuServe menus (saving you time and money) and how to create your own custom menu. An "On-Line Survival Kit" is included in the Appendix that sum-

marizes the commands used in the different areas. It is arranged in a logical, easy-to-reference manner.

#### Conclusion

I've been a CompuServe subscriber for nearly three years and I feel comfortable with the services I normally use. Yet I still felt intimidated by the costs of learning new aspects of the network.

During one of my first experiences with CompuServe, I found myself watching screen after screen of text roll by without knowing how to stop it. I frantically searched the manual trying to find the code to terminate it. In frustration, I turned the power off to the modem, disconnecting myself. After calming down, I realized I had just thrown away a half hour of the free time given to new subscribers. I'm sure many other people have had the same type of experience.

The alternative to purchasing *How to Get the Most Out of CompuServe* would be to order the many different user manuals from CompuServe, which explain the areas within the network. But these do little to eliminate the intimidation, confusion, and frustration felt by new users.

This book will save you time and money, from log-on to sign-off. It is for anyone interested in using CompuServe more efficiently, whether a first-time user or experienced veteran. ■

### Great Zeus: A Solid Model I/III/4 Editor/Assembler

by Ronald A. Cangro

When I first got Cosmopolitan Electronics' Zeus Editor/Assembler, I was a little disappointed to find that it had a line-oriented rather than a screen-oriented editor. But my apprehension dissipated when I used the system and found it to be fast, versatile, and full of features not found in other editor/assemblers.

Zeus combines the best characteristics of both a line and a screen editor. You can edit anywhere on the screen by moving the nondestructive cursor, but program changes affect the current line only, speeding correction time. And the assembler supports some impressive features: multiple ex-

pressions on a single line, a three-pass assembly operation that significantly speeds up assembly time, comment blocks at the beginning of the object code, and labels. While Zeus lacked a few things, like a macro capability, a built-in debugger, a direct assembly to memory, tape input/output, and a cross-reference facility, it's a good package for developing small- to medium-sized programs.

#### The Editor

The disk has its own operating system, MULTIDOS (also manufactured by Cosmopolitan Electronics), that runs on a Model I, III, or 4. When you boot up Zeus, the familiar DOS logo appears. Loading Zeus from disk automatically puts you in the edit mode.

The Zeus editor has two modes of operation: line-oriented and character-oriented. On boot-up, you're in the line-oriented mode and you invoke all commands with a single keystroke. Most of the letters correspond to the functions they perform: L loads a source file, D deletes a line, and I lets you insert code (see Table 1 for a complete list of commands).

Once you load text in the buffer, you can scroll through it; you display a full page of text (16 lines) by pressing the enter key.

Edit commands let you find specific

### Zeus Editor/Assembler



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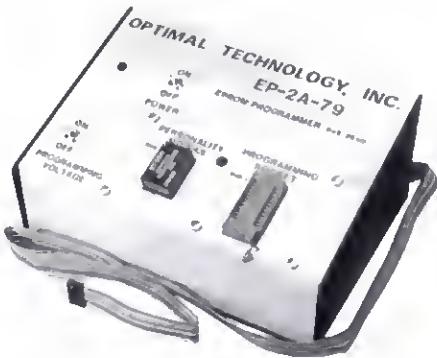
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## REVIEWS

text character sequences, exact line numbers, and even lines referenced by a specific label. And you can insert text at any time with dynamic line renumbering, allowing unlimited text insertion between any two lines.

You can edit any character within a specific line by using the Edit command, which puts you in the character-oriented edit mode. This is similar to the Basic interpreter editor, with one exception: you see exactly what you're editing at all times. The nondestructive cursor moves left and right over the line, and you use simple control sequences to delete, insert, or overtype a character, or to move to the end of a line. Use either the down-arrow or clear keys as the control key.

The editor allows a global search and replace of a particular string. For example, you could change all occurrences of STRING1 to STRG1 in one operation. Single-quoted text and comments remain unaffected unless you specify that option. This is a flexible and useful command although it doesn't work on opcodes and operands. You can also move or duplicate a line (or group of lines) anywhere in the text buffer.

It's possible to display the amount of memory the source text, symbol table, and Get file buffers use, as well as how much memory you have left. This is helpful in gauging where to split your source text.

Although you probably won't realize it until it's too late, Zeus's most useful editing command is X. You use it to recover source text when restarting Zeus. You only have to crash your computer once to appreciate it.

The editor also checks every source line for correct syntax as you enter it. It even checks the source code that you load from an ASCII file or an EDTASM format file before putting it in memory. This saves a lot of time tracking down elusive syntax errors during assembly.

Since Zeus allows editing and assembling without destroying the source code in memory, you may think this means there isn't much room left for serious programming. But the program allows 34K for source and symbol code, and supports the Get pseudo-op that makes it possible to break your source code into modules and store them on disk. The assembler then reads the disk files in sequence. You could actually use the 34K for symbol table storage only.

One handy feature that Zeus lacks is a keyboard macro capability, which would have made it easier to enter commonly used phrases and words with a single keystroke.

### The Assembler

The assembler has a rich assortment of features. Table 2 lists the available pseudo-ops. It supports the common

Intel and Zilog pseudo-ops, including multiple expressions on the same line with the DB, DW, and equivalent pseudo-ops. This feature alone makes it worth the price.

It handles conditional assemblies using the If...End...If clause and an ERR error switch. Zeus also provides an assortment of subcommands to control assembly listing and printout, error-handling, object-code generation, and symbol tables. Table 3 shows the assembler subcommands available.

While the assembly is in progress, you can pause and restart the listing. It uses 16-bit operations while evaluating expressions. It does multiplication, division, addition, subtraction, and modulo arithmetic as well as the logical Or, And, left and right shift, and exclusive Or in label evaluation.

One of Zeus's unique features is its three-pass operation. During the first pass, the assembler creates the symbol table and defines the values of the DS, End, EQU, and ORG pseudo-ops. After this phase, you can reference all the lines by label names. During the second pass, the assembler does the actual assembly and directs output to the screen and object file. It then sets a flag. All the additional assemblies with this flag set will proceed with pass three; an instant assembly on all processed source code in the buffer. This definitely speeds up development time.

Command	Description
A	Assemble source code
B	Command mode calculator
C	Global change
D	Delete line(s) from the text buffer
E	Edit specific text line
F	Print line with the specified label
G	Printer format command
H	LPRINT line(s)
I	Insert line(s)
J	LPRINT raw data
K	Kill file
L	Load file
M	Move/duplicate text line(s)
N	Reset (new) text buffer
O	Opcode/operand Reference
P	Print line(s)
Q	Quit/exit
R	Reference
S	Save file
T	Print sorted label table
U	Memory used
X	Recover source text on reentry

Table 1. Zeus editor/assembler commands.

Pseudo-op	Description
COMM	Comment
DEFB or DB	Define byte
DEFL or DL	Define label
DEFM or DM	Define message
DEFS or DS	Define space
DEFW or DW	Define word
End	Terminate assembly
ENDIF	Delimit conditional assembly
ERR	Abort assembly
EQU	Equate
Get	Include source from disk file
If	Begin conditional assembly
List	Control printing
ORG	Origin
Page	Eject to top-of-form
SBTL	Subtitle
TITL	Title

Table 2. Assembler pseudo-ops.

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Another unique feature is the COMM pseudo-op. This generates a comment block at the beginning of the object file. It lets you identify your object code by listing the first portion or by using a disk-zap utility.

#### Additional Assembler Features

Other features abound. The program has a built-in calculator that lets you convert from decimal to hexadecimal and back again. You can access this from the edit mode.

Many assemblers' weak point is in printing out the source listing. Zeus includes a configuration program; in addition to modifying object code to work with different disk operating systems, the ZCON program sets up printer defaults. You can specify the number of printed lines per page, number of characters per line, total number of lines per page, and whether to use a form-feed or line-feed top-of-form. You can output raw data to the printer at any time with the J command. This lets you send special printer codes even when you're in the middle of an edit session.

Labels have also been a sore spot in other assembler packages. Zeus allows every character and character case to be significant. This amount of flexibility makes the code almost self-documenting.

The disk operating system deserves some mention. You receive a mini-copy of MULTIDOS called \*ZEUS\* supplied on a single-density disk. It has the capability of operating in double-density mode with automatic hardware recognition and automatic density recognition. Table 3 shows the library commands that are available in \*ZEUS\*.

#### Documentation

If there's one area where Zeus could use some improvement, it's in the documentation. The problem is more of quantity than quality. What is documented is done fairly well. There's a section detailing each command operation, a fairly large part on the pseudo-ops, and a brief section explaining the creation of system disks and backup copies.

The problem is the lack of a tutorial to show you how to load the editor, enter a simple program, then assemble and list it. As it is, a user is on his own and has to sort through the command

Command	Description
Append	Add one file to the end of another
Auto	Automatic, invincible execution of a command or executable file on power-up
Boot	Reboot the system
Clear	Clear memory from \$200 to TOPMEM
Clock	Enable/disable screen clock
CONFIG	Set default drive attributes on power-up (stepping speed, density, and number of sides)
Date	Set date
DIR	Print disk directory (5 options)
Dump	Transfer memory to disk file
Forms	Set printout parameters
Free	List available disk file space
Kill	Remove a file from the disk
LIB	Print a list of the library commands
List	List a file on the video screen
Load	Load an object file from the disk to RAM
Patch	Modify a disk sector
Print	List a file to the printer
Rename	Change a file name
RESTOR	Recover a killed file
SETCOM	Set RS-232 parameters (Model III only)
SETDIR	Alter directory address marks (Model I only)
Skip	Read a 40-track disk in an 80-track drive
Time	Set time
TOPMEM	Set upper memory limit
Verify	Reread disk sectors for errors
\$	Duplicate a single file (similar to Copy)

Table 3. \*ZEUS\* library commands.

examples to understand all of Zeus's features. I'm still not sure how to exit the program back to DOS without resetting the computer.

An index would also have been a useful addition, especially if the documentation were expanded. Also missing is a description of all the Z80 op-codes. The assumption is that the user is familiar with Assembly language and requires a fast, inexpensive, easy-to-use-assembler.

#### Conclusion

Zeus is a system that should be used by people who require a powerful package to develop smaller programs. But for people who do a lot of sophisticated programming, it's limited without a macro capability, a built-in debugger, a direct assembly to memory, tape input/output, or a cross-reference facility.

On the positive side, it doesn't require disk overlays. The editor is very capable and as easy to use as a full-screen editor. Best of all, it isn't necessary to transfer it to another operating system because \*ZEUS\* is powerful enough all by itself.

Zeus is a logical progression from the popular EDTASM program. If EDTASM satisfies your programming needs, you may want to check out Zeus. ■

## This is TRSDOS 6.2

by Hardin Brothers

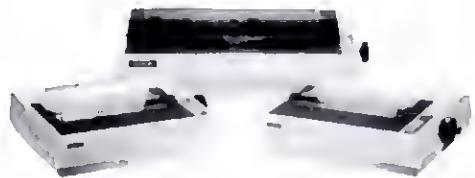
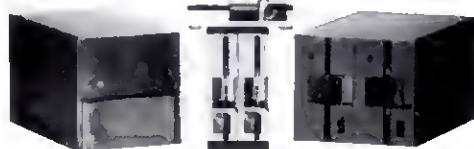
Logical Systems Inc. has made microcomputer history by publishing the (almost) complete source code for TRSDOS 6.2 in three volumes. To my knowledge, this is the first time that the source code for a new and living operating system has been published for distribution. Of course, these books aren't inexpensive; at \$99 apiece, they may have established a record as the most expensive paperback books ever published.

#### Inside the Books

For your \$99, you get an 8½- by 11-inch book filled with commented TRSDOS source code. Volume 1, *The System*, contains the source code for Boot/SYS (or Lowcore), SYS0/SYS (also called Sysres, since it always re-

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## REVIEWS

mains resident in memory), SYS1 through SYS5 and SYS9 through SYS13.

Volume 2, *The Libraries*, contains the source code for the library modules SYS6 through SYS8. The final volume of the series, *The Utilities*, includes the source code for almost all the TRSDOS 6.2 utility programs.

The three books contain almost 1,100 pages of code, enough to keep even the most dedicated hacker reading and studying for weeks (if not months). LSI prefaces each program with a short description of the functions it performs. The comments throughout the books are sufficient to give an experienced Assembly-language programmer all the information necessary to understand the programs' inner workings (see the sidebar for examples from *The Source*).

### Who Needs These Books?

Why would anyone want such a set of books? Radio Shack has exorcised most of the Model 4 TRSDOS bugs. And it's unlikely that anyone will use them to type in all 1,100 pages of code, since TRSDOS is distributed free with the Model 4/4P.

I think there are four important and likely uses for these books. First, some

people (including me) just like to know how things work. How does TRSDOS handle the video screen? How does it parse commands? What happens when you install Memdisk? If you want to know as much as possible about your Model 4, these books (along with Radio Shack's *Model 4*

*Technical Reference Manual*) will provide all the answers a software nut could want.

Also, you may want to make modifications to your personal copies of TRSDOS 6.2. Perhaps you'd like to reinstate the Kill command, in addition to Remove, from DOS Ready.

### Notes from *The Source*

#### by Hardin Brothers

Below are some examples of technical information culled from *The Source*. Be sure to make any DOS changes to a back-up copy of TRSDOS 6.2—not an earlier version—and to test the new code thoroughly before moving it to your working copies of the system disk.

• Generally, when you reboot your computer, programs in memory are left untouched. However, TRSDOS 6.2 uses memory locations 4300-43FF hexadecimal for the boot routine, so any program in that area will be destroyed.

• If you want to change the definition of the function keys temporarily while in Basic, the lookup table with their values is stored from 0918-091D hexadecimal. The values are stored in this order: F1, shift F1, F2, shift F2, F3, shift F3. You can POKE new values into those bytes, but the computer will react improperly if you try to define them as break, clear, or pause. Be sure to reset the values (or reboot the computer) before using any program that expects the F keys to have their original values.

• You need change only a single byte in SYS1/SYS to activate the Kill command in addition to Remove. LIB will also add Kill to the list of commands it displays if you add this patch:

PATCH SYS1/SYS.LSIDOS (X'2054' = "K")

• The @DATE SVC puts a formatted version of the system date into a buffer as MM/DD/YY. But it also returns with DE pointing to DOS's date storage area (DATE\$+0) at 0033H. The storage scheme is:

DATE\$+0 Year (80-87)  
DATE\$+1 Day of month (1-31)  
DATE\$+2 Month (1-12)  
DATE\$+3 Bits 0-7 of day of year

DATES + 4 Bit 0 = bit 8 of day of year  
Bits 1-3 contain day of week  
Bit 7 set if leap year.

You could find the day of the week in Basic with this code:

D% = ((PEEK(&H0037) OR 14)/2) - 1  
DS = "SunMonTueWedThuFriSat"  
DAYS = MIDS(D\$, D%\*3 + 1, 3)

• A 2-byte patch space in the Click/FLT makes the audible click operate on a specific key or set of keys. The current code is:

2474 0000 1060 DW 00  
2476 201C 1070 JR NZ, LEAVE

Also, at 247A hexadecimal, the computer loads the D register with the click tone value and the E register with the click duration value. One interesting change to the Click/FLT is the following:

.Patch to CLICK/FLT.FILTER to make a beep only when <ENTER> is pressed.

.First, test for <ENTER>  
X'2474' = FE 0D

.Set the duration  
X'247B' = 80

.Set the tone  
X'247C' = FF

.End of patch.

• I dislike the Device command default parameters. I'd much rather have the D parameter default to off and the B parameter default to on. This patch will accomplish that:

.Patch to change DEVICE defaults  
.Apply to SYS6/SYS.LSIDOS

.Position to DEVICE Library command L61

.Set D parameter to default D = N  
X'241E' = 00 00

.Set B parameter to default B = YES  
X'2580' = FF FF

.End of patch

### The Source: TRSDOS/LS-DOS 6.2



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## REVIEWS

The necessary bytes are sitting in SYS1/SYS's command interpreter just waiting for you to change a NOP byte (00H) to a 'K'. Perhaps you want to add your own supervisory calls (SVCs) or to determine the side effects of some of the present calls.

You could also use the books to create your own utility programs that take full advantage of what's already available with TRSDOS 6.2. I've experimented recently with a split-screen terminal program for CompuServe's CB simulator and special-interest group conference areas. I have the program working as a dumb terminal, but I'd like to add a capture buffer and other enhancements found in the TRSDOS's COMM program. After studying COMM's source code, I've found ways to add the appropriate patches. I won't have to spend hours duplicating work that has already been done.

Probably the most important purpose of the source code is to give software developers all the help they need in producing packages for the Model 4. The inner workings of the Model I/III ROMs have been published for several years, and have helped software writers considerably. A similar knowledge of the Model 4's operating system may (hopefully) lead to more interesting and complex programs for the Model 4.

### What's Missing

While these books are nearly complete, they do lack a few things. Whenever the code accesses the Model 4's hardware directly through a port, the source lines have been omitted but the object code is still present. I assume these omissions are made to respect Tandy's proprietary secrets and also to mark those sections of code that are specifically Model 4-oriented (the same code is essentially used for Model II, 12, and 16 computers, and LSI hopes that other manufacturers of Z80 computers will begin using TRSDOS 6.2 as well).

Also, the source code for the Help utility is missing from Volume 3. This last omission is unfortunate, because the Help command can be expanded to cover topics in addition to DOS commands. As of this writing, neither LSI nor Tandy has explained how to do so (I will, however, discuss how to add new Help files in a future install-

ment of The Next Step).

Missing from these books, of course, is the Basic source code (owned by Microsoft) as well as MODELA/III, probably for similar reasons. But I didn't expect to see either of those.

These books are an important addition to my library. It's one thing to be able to use TRSDOS 6.2 well; knowing the source code gives you more in-

sight into how programs interact with the system. Whether you should buy one or all of these books depends on your level of sophistication and the complexity of the programs you need to write. The wealth of information in these books isn't difficult to find or understand, but their cost may deter many hackers and hobbyists from buying them. ■



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# PROJECT 80

*Continued from p. 130*

*Listing continued from p. 130*

```

7867 ES 01878      PUSH   BL      ; THE STACK
7868 DS 01888      PUBB   DE
7869 3E18 01898      LD     A,10B
786B D3EC 01188      OUT    (TRSEXE),A
786D DBE9 01118      IN     A,(TRSDI)
786F C55F 01128      BIT    3,A
7871 281A 01138      JR    NZ,NOTHER
7873 380C 01148      LD     A,BCH
7875 D328 01158      OUT    (PICPB),A
7877 DB28 01168      IN     A,(PICFB)
7879 C87F 01178      BIT    7,A
787B 2810 01188      JR    Z,NOTHER
787D C827 01198      SLA    A
787E 2800 01208      ; GET TABLE OFFSET
787F E60F 01218      AND    SPH
7881 210078 01228      LD     HL,INTTEL
7884 5F 01238      LD     E,A
7885 1680 01248      LD     D,0
7887 19 01258      ADD    RL,DE
7888 5E 01268      LD     E,(RL)
7889 23 01278      INC    HL
788A 56 01288      LD     D,(HL)
788B EB 01298      EX    DE,HL
788C E9 01298      JP    (BL)
788D 21BC78 01320      NOTHER LD     BL,RESTOR
788E 85 01338      PUSH   BL
7891 2A1270 01348      LD     BL,(VECTOR)
7894 E9 01358      JP    (BL)
7895 1825 01368      JR    RESTOR
7897 3A1170 01388      TIMER# LD     A,(TINCNT)
789A 3C 01398      INC    A
789B 321178 01408      LD     (TINCNT),A
789E F8B4 01418      CP    4
78A0 2R8E 01428      JR    NZ,DONE
78A2 AF 01438      XOR    A
78A3 321178 01448      LD     (TINCNT),A
78A6 3A1078 01458      LD     A,(PPIBYT)
78A9 C618 01468      ADD    A,18H
78AB 321078 01478      LD     (PPIBYT),A
78AE D321 01488      OUT   (PPIB),A
78B0 3E24 01498      DONE
78B2 D324 01508      OUT   A,24H
78B4 3EF4 01518      LD     A,0F4H
78B6 D324 01528      OUT   (PITTE),A
78B8 3E28 01538      BADINT LD     A,28H
78B9 D328 01548      OUT   (PICFB),A
78BC 3E08 01558      RESTOR LD     A,08H
78BE D3E8 01560      OUT   (TRSINE),A
78C8 D1 01578      POP    DE
78C1 E1 01588      POP    HL
78C2 F1 01598      POP    AF
78C3 FB 01608      EI
78C4 C9 01618      NOPROC RET
7814 01628      END   INTRPT
00000 TOTAL ERRORS
25366 TEXT AREA BYTES LEFT

```

one second. Using the 250 KHz clock, the count value of 0F424H results in a 0.25 second interrupt. Thus, four interrupts will make up one second.

The last part of the initializing section requires that we provide for other system interrupts. If an interrupt occurs and we determine that the 8259A is not interrupting the CPU, we jump to the location otherwise used by the system.

The interrupt service routine first sends a 0CH (OCW3) to the 8259A, telling the 8259A that we are using polled mode. The 8259A then sends back a value which tells the interrupt status of the controller (see Fig. 12). If the high bit (bit 7) is set, an interrupt is being requested. Also, if an interrupt is being requested, the highest priority interrupt is given by the lower three bits of the returned byte. This can be used as an offset into a table of ISR addresses (by first shifting it left one bit).

If the ISR determines that the 8259A did not generate the interrupt, service is passed to the normal TRS-80 ISR. Otherwise, it adds one to its count variable. If four interrupts have not yet occurred, it finishes by restarting the 8253 timer for another 0.25 second interrupt, and issuing a non-specific end-of-interrupt (EOI) to the 8259A via OCW2. This tells the 8259A that servicing is complete for the interrupt just required, and to arbitrate the next lower priority interrupt. Interrupts are then re-enabled, and a return from interrupt is executed.

*End*

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# PROJECT 80

If the interrupt was found to occur from the 8259A, the count variable is cleared (to count four more interrupts) and the LED display is updated by 1. The service routine then finishes by restarting the 8253 timer and sending the EO1 to the 8259A.

## Conclusion

The 8259A interrupt controller provides more capability and flexibility than described here. If you are interested in some of the more advanced applications of the device, you should get a copy of the data sheet from Intel Corporation. Since the G.P. I/O board project also comes in CMOS (which may be important to some of you), the 8259A is available in CMOS from the same sources. ■

### 1983 Intel Microprocessor and Peripheral Handbook

Intel Corporation  
Literature Department  
3065 Bowers Avenue  
Santa Clara, CA 95051

Zilog 1981 Data Book  
Zilog, Inc.  
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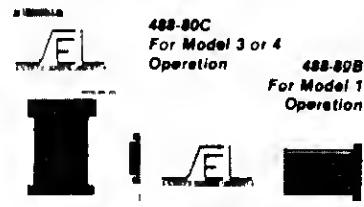
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## UNITED SOFTWARE ASSOCIATES

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Ultra Term Version 2 is the most powerful communications programs available for the TRS-80. The package includes a full featured terminal program, a self relocating host program and hex conversion utilities for bulletin board downloading, all at prices lower than competing programs with less features. Ultra Term features include: Ultra Term supports auto dial modems with an easy to use dial menu capable of supporting any modem that accepts dial commands from the RS-232 port or by pulses on the RTS line or cassette port, including the Radio Shack Modem 2, Hayes Smartmodem, or the Lynx auto dial Ultra Term Version 2 is the only terminal program for the TRS-80 that has a true prompt controlled auto logon feature. This feature, when used in conjunction with our auto dial feature allows the user to issue a single command to select a number to dial, set RS-232 parameters, dial the number, wait for prompts from the system being called, and answer multiple questions to sign the user onto the system being called. No other TRS-80 terminal program available offers this power and versatility. Ultra Term is the only program that offers a direct to disk file transfer mode that allows full control from the transmitting computer, and unattended operation at the receiving computer. This gives you the ability to transfer multiple files or an entire disk with no one present at the receiving computer. Ultra Term has an exclusive split screen feature that allows simultaneous two way communications from terminal mode and supports line printers with a 1K print buffer. Ultra Terms universal ASCII format file transmission supports delays between characters or between lines, as well as prompt controlled transmission for compatibility with virtually all systems. A counter continuously displays the amount of free memory remaining whenever the buffer is in use. Ultra Term will run on a Model 1 or Model 3 TRS-80 disk system with any TRSDOS compatible operating system (RS-232 and Modem required).

Ultra Term Version 2 retail price \$79.95

Upgrade for current Ultra Term Version 1 owners \$24.95 (For Upgrade, you must return your original version 1 disk.)

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The INFOEx-80 bulletin board program contains all the software necessary to set up your own bulletin board service or message center. The Infoex-80 software automatically answers phone calls, displays a logon message or bulletin, allows callers to enter and retrieve messages, and lets users chat (type) directly to the system operator. Infoex-80 supports uploading and downloading in both universal ASCII format and Ultra Term disk file transfer format for accurate and fast file transfer. Infoex-80 allows users to apply for individual passwords, so private password protected messages can be left for any user. The system also keeps track of the number of times each user has accessed the system, as well as the highest message each user has read and advises each user when messages have been left for them. The program requires a TRS-80 Model 3 (or Model 1 with double density adapter), 2 disk drives, 48K ram, RS-232 interface, any auto-answer modem and a DOS that supports the CMD "Discmd" from BASIC (Any DOS but TRSDOS).

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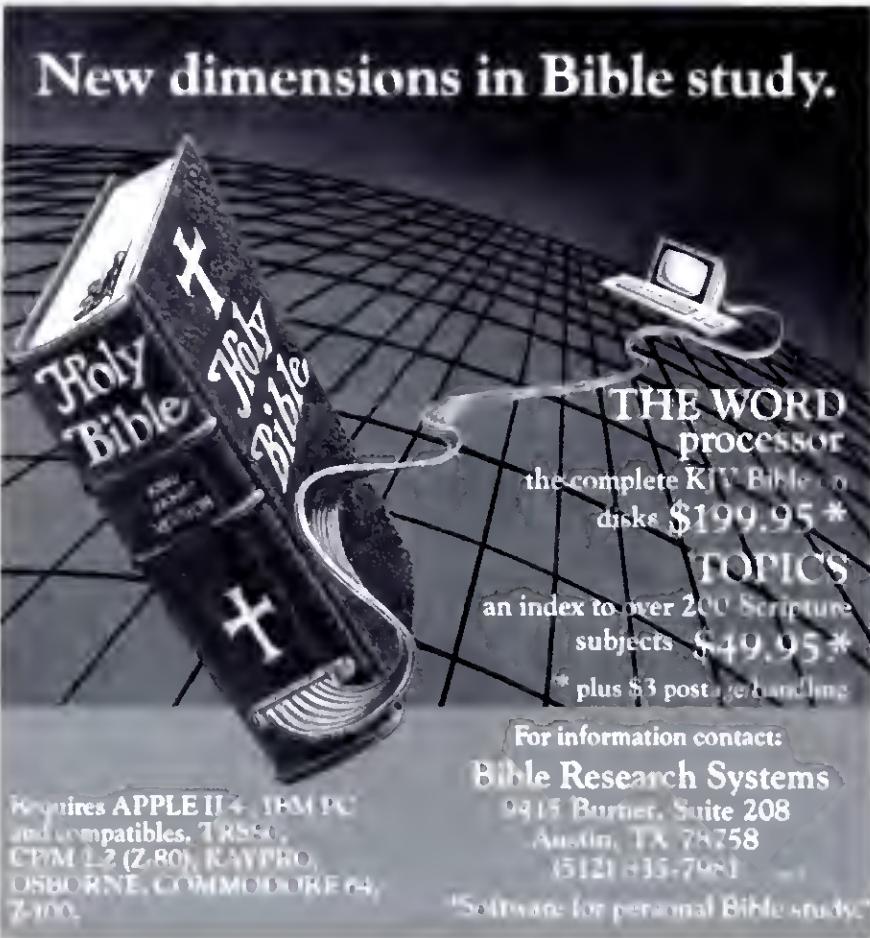
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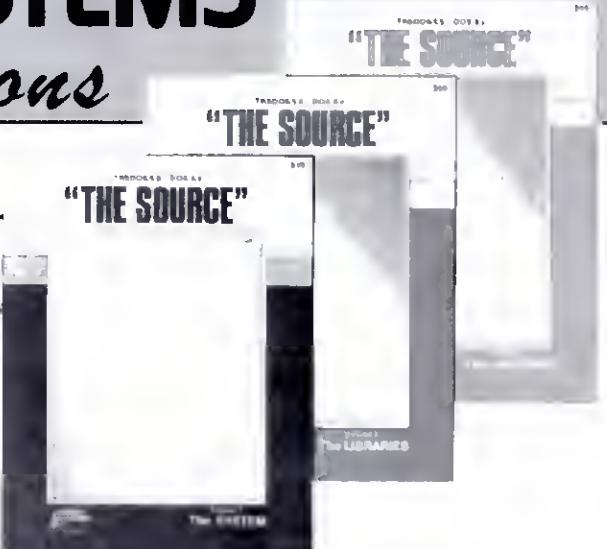
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The TRSDOS/LS-DOS 6.x operating system assembled source listings, with comments, as implemented on the TRS-80 Model 4. The three volume set of over 1000 pages, covering the SYSTEM, the LIBRARIES and the UTILITIES is priced at just \$249 for the complete set, or \$99 individually.

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### Fast Impressions

The Fastext-80 bidirectional dot-matrix printer (\$259) gives you 80 characters per second (cps) print speed at 10 characters per inch (cpi), and features a line buffer and six-pitch capability.

Fastext-80 also features a self-test switch, an 80-character print line, emphasized or elongated print, and bit-image graphics.

Pitches include pica, elite, condensed, and enlarged printing. The printer supports the 96-character ASCII set and can print in seven languages.

Its drop-in cassette ribbon has a life of one million characters. Fastext-80 comes with friction feed and a Centronics parallel interface. A tractor feed is also available.

For more information contact Smith-Corona at 65 Locust Ave., New Canaan, CT 06840, 203-972-1471.

Reader Service **563**

### Running with IBM

Xcalibur, from Micro Projects Engineering Inc. (3951 Higuera St., Suite B, Culver City, CA 90230, 213-202-1865), lets you run IBM PC software on the Models I, III, 4, and 4P.

This enhancement board gives you PC compatibility to run MS-DOS 2.11, Multimate, dBase II, WordStar, MultiPlan, and other popular IBM PC software packages. Add a monochrome monitor card (\$199.95) and



*The Fastext 80 dot-matrix printer prints seven languages in six type fonts.*

128K RAM (\$198) and you can run Lotus 1-2-3.

Xcalibur comes with an IBM-compatible bus connector for use with IBM expansion cards and MS-DOS. It installs easily through cable connections inside your computer.

The Xcalibur board is \$495, and includes an MS-DOS disk. Additional RAM chips and other upgrade hardware are also available.

Reader Service **552**

### Adventures In Pixieland

Pixie Quest, from Seal Software (4 White Birch Court, Turnersville, NJ 08012, 609-228-6169), is a Model 1 adventure game that leads you and your companions on a trip through the forbidden wood of Balmar and the caves of the evil sorcerer, Tralon.

Your goal is to return pixies Frolic and Pixel to the

village of Brahlee. Along the way you'll find treasures, puzzles, and meet jabwockies, ogres, and evil gremlins.

The game's parallel paths through the woods mean that failure to solve a puzzle won't leave you at a dead end. Ultimately, however, you must cope with every predicament using ingenuity, imagination, and whatever you find on your journey.

Pixie Quest (\$34.95) requires 48K RAM and one drive.

Reader Service **553**

### Programming for Fun

When you're tired of working with your TRS-80, *101 Programming Surprises & Tricks for Your TRS-80 Computer* (\$10.95) gives you games, novelties, and techniques to make computing fun again.

This strictly-for-fun programming guide includes

music and sound programs, animation programs, one- and two-player games, and programming tricks useful for more serious programming applications.

If typing in listings cramps your style, a disk that includes all the programs is available for \$19.95.

For more information contact Tab Books Inc., Blue Ridge Summit, PA 17214, 717-794-2191.

Reader Service **554**

### Model 100 Means Business

*Business Finance* (\$39.95) is Tandy Corp.'s 12-program financial analysis package for the Model 100. Calculation programs calculate net present value, internal rate of return, financial management rate of return, and depreciation.

Also included are analysis programs for rent or purchase decisions, lease/purchase analysis, machinery replacement, and bond analysis.

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*Business Finance* requires 16K RAM and is available from Radio Shack stores.

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### Computer Card Game

Casino, the card game, is now a computer game. You play against your Model I, III, or 4, as it keeps score, shuffles the cards, and plays dealer.

The game includes an instruction manual with sections on rules of the game and playing strategy. Casino is available on 16K cassette (\$12.95) or 32K disk (\$16.95). Contact Dyna-comp (Catalog Dept., P.O. Box 18129, Rochester, NY 14618, 716-442-8960) for more details.

Reader Service ✓ 557



*Workstation 100 makes using your Model 100 easier.*

### Portable Accessories

The Workstation 100 kit (\$45.95) contains six attachments (also available separately) to make your Model 100 more efficient.

The Power-100 (\$29.95) is a rechargeable battery pack that powers the Model 100 for 9-12 hours. Support legs (\$3.95) angle the Model 100 for easier typing.

The kit also includes a clip-folder typing stand (\$7.55), a pen (\$2.75), a mechanical pencil (\$1.75), and a battery case (\$3.95). Attachments are compact enough to fit into the Model 100 carrying case.

Contact A.R.M.S. (12131 Old Buckingham Road, Midlothian, VA 23113, 804-794-6675) for more information.

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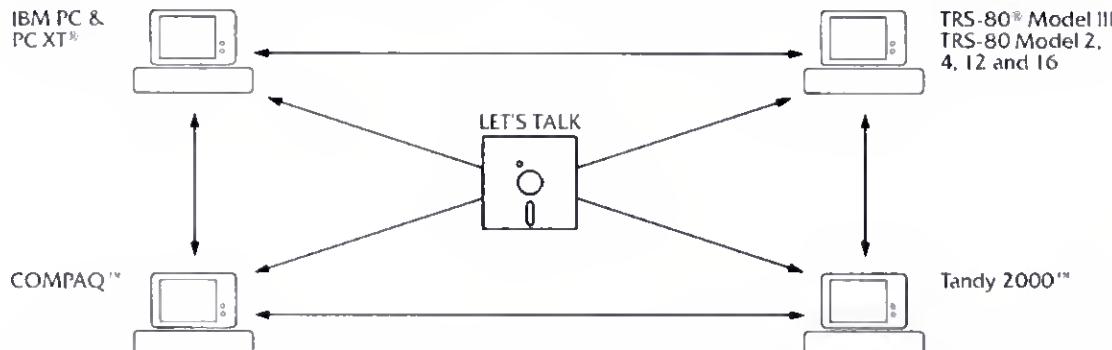


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## NEW PRODUCTS

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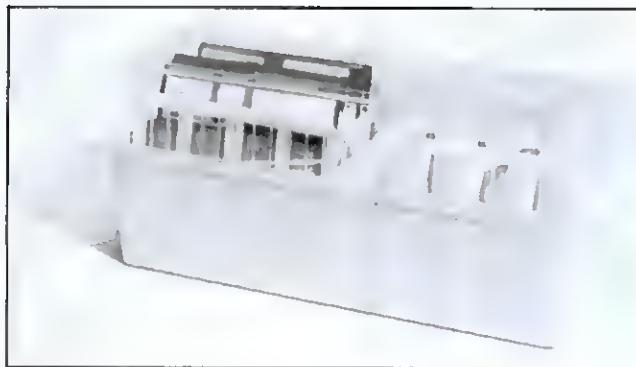
The program displays each tax form. You enter the data, and Tax Commissioner computes and prints out the tax return. You can print data only, or choose from more than 35 pre-printed forms.

Tax Commissioner requires a Model 2000, or a Model III/4 with CP/M 2.2. Contact TAXbyte Inc., 3803 28th St., Moline, IL 61265, 309-764-7245 for more information.

Reader Service **✓ 567**

### Super for the Model 4

Super, the data base management system from the Institute for Scientific Analysis Inc., is available



*Soho Corp.'s stackable disk boxes are \$4 each.*

for the Model 4. Super 2.3 is menu-driven, and features on-screen editing, a calculator program, and a filing system.

The program lets you set up and create data bases, save report formats, print reports, and sort information. Super 2.3 is available for the Models I, II, and III. It costs \$199 and includes a manual. The program is also

available as an upgrade.

For more information contact Institute for Scientific Analysis Inc. at 36 E. Baltimore Pike, Suite 106A, Media, PA 19063.

Reader Service **✓ 564**

Corp. stores up to 60 5 1/4-inch disks.

It features a smoke-tint see-through cover and has four plastic dividers for organizing disks. Disk boxes stack for easy storage. For more information contact Soho Corp. at P.O. Box 20081, Ferndale, MI 48220, 313-543-5209.

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### Graphics Answers

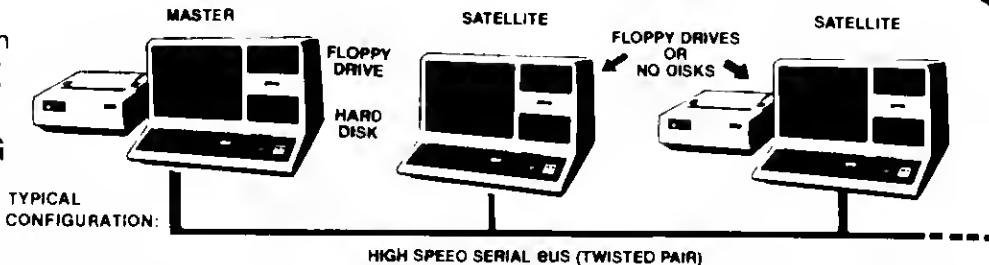
The Inovion Personal Graphics System (PGS) is a 78K RAM stand-alone graphics generator that creates up to 2.1 million different colors.

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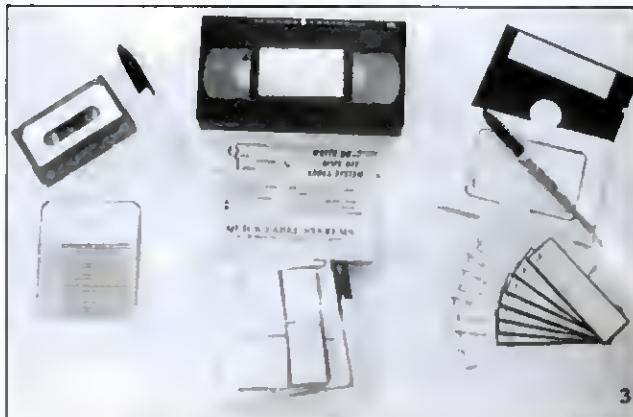
Synthetic color routines change the color saturation or hue of a group of pixels. PGS retains textures and three-dimensional quality while enhancing colors.

PGS is \$3,495 from Innovation Corp., 195 E. Gentile St., Layton, UT 84101, 801-546-2850.

Reader Service **✓ 566**

### Computer Calling

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Reader Service **✓ 560**

### Label Mark-ups

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Reader Service **✓ 551**



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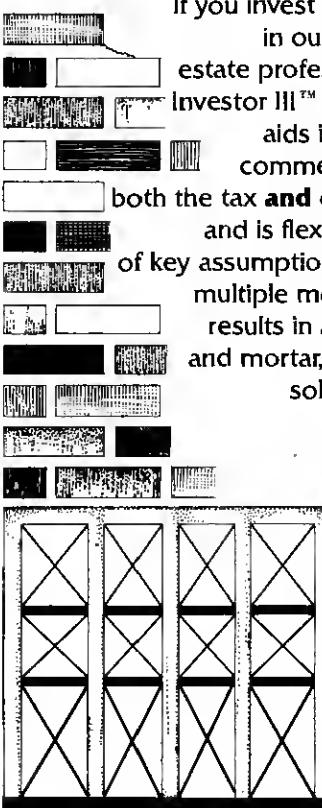
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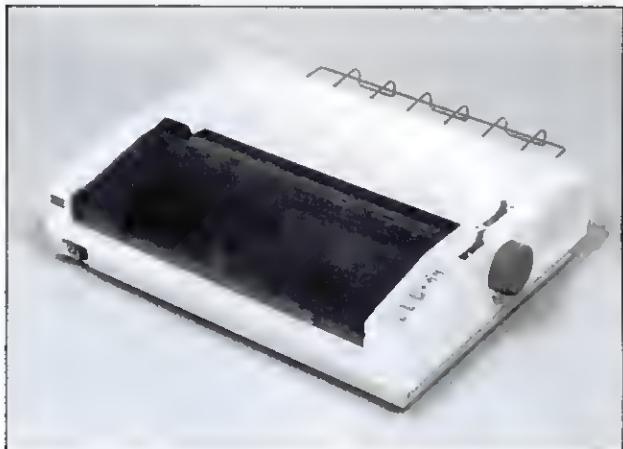
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Fujitsu America's compact DPMG9 dot-matrix printer runs at 180 cps.

### Fujitsu Ink

The Model DPMG9 compact dot-matrix printer (\$695) from Fujitsu America Inc. boasts 80-column, bidirectional printing with 180 cps draft-quality printing (25 cps correspondence-quality).

The printer features friction and tractor feeds, automatic perforation skip, 255 character fonts, and a language-select function. It prints international characters, superscripts, subscripts, and images.

The DPMG9 weighs 19 lbs. and measures 12 by 16 by 4 inches. A Centronics interface is standard, with RS-232 interfacing available.

For more information contact Fujitsu America Inc. at 3055 Orchard Drive, San Jose, CA 95134, 408-946-8777.

Reader Service ✓ 561

### Write the Volks

Volkswriter Deluxe (\$295), the popular word processor for the IBM PC, is available for the Models 1200 and 2000.

Features include foreign-language and scientific character sets, on-screen tutorials, multiple fonts and colors, and compatibility with Lotus 1-2-3, VisiCalc, and other commercial spread-

sheet programs.

Volkswriter Deluxe for the Model 2000 takes advantage of the Model 2000's extra memory, faster processing speed, and color capabilities.

Minimum system requirements are 128K RAM and two drives. Volkswriter is available through Radio Shack stores. Contact Lifetree Software Inc. (411 Pacific St., Monterey, CA 93940, 408-373-4718) for more information.

Reader Service ✓ 568

### Tenant Fever

Good Software Corp. (12900 Preston Road, Dallas, TX 75230, 214-239-6085) has announced the Real Estate Investor III package for the Models 1000, 1200, and 2000.

Investor III (\$249) uses your criteria to analyze real estate investment potential, and generates profit projections for potential investments. Projections range up to 20 years for more than a dozen financial criteria. Tax formulas are based on 1985 tax laws.

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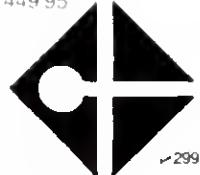
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Reader Service **✓ 558**

Professional Options package, and WordStar Professional package are available for the Models 1200 and 2000.

WordStar (\$495) features self-help menus, block moves, global word search, justification, and formatting. Print options include boldface, underline, double strike, overprint, superscript and subscript.

WordStar Professional Options package (\$345) contains three utility programs for WordStar. The MailMerge text merging utility creates form letters. CorrectStar checks spelling against three dictionary files (1,500-65,000 words).

StarIndex creates indexes, tables of contents, and lists of figures and tables automatically. Programs are also available separately.

The WordStar Professional (\$695) includes WordStar, MailMerge, CorrectStar, and StarIndex. For more details, contact Tandy Corp./Radio Shack at 1800 One Tandy Center, Fort Worth, TX 76102.

Reader Service **✓ 565**

### Stellar Words

The WordStar word processor program, WordStar



**Able Enable**

Enable (\$695), an integrated package for the Model 1200, includes word processing, a spreadsheet, graphics, database management, and telecommunications.

Modules offer fast, easy transfer of data. Enable integrates data from all modules in one window for printing or data transmission. You can create graphs from the spreadsheet or data base program, then insert the graphs, spreadsheet, and data base data into a word processing document on screen.

The system is compatible with files from dBaseII, Lotus 1-2-3, VisiCalc, WordStar, EasyWriter 1, and Volkswriter. Enable also lets you use modules simultaneously. For instance, you can use the spreadsheet program, print a report, and receive stock quotes over the wire all at once.

Current owners of Lotus 1-2-3 can buy Enable for \$200, and dBase II users can buy it for \$400, with proof of purchase. For more information contact The Software Group at Northway Ten Executive Park, Ballston Lake, NY 12019, 800-338-4646.

Reader Service **572**

**PFS:Planning**

Software Publishing Corp. (1901 Landings Drive, Mountain View, CA 94043, 415-962-8910) offers a full line of PFS: products, including its new PFS:Plan spreadsheet program for the Models 1200 and 2000.

PFS:Plan (\$140) lets you develop budgets, forecasts, and other financial models without learning complex program formulas and command sequences.

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Other PFS: series programs include the PFS: Write word processor (\$140), PFS:File information management program (\$140), PFS:Report report generator (\$125), PFS:Graph chart and graph program (\$140), PFS:Proof spelling checker (\$195), and PFS: Access communications program (\$195). PFS:File and PFS:Report are also available for the Models III, 4, and 2000.

Reader Service **571**

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The three-disk Model 4 package features built-in instructions and a menu for easy use. It's available at Radio Shack stores. Contact Clinical Reference Systems (P.O. Box 20308, Denver, CO 80220, 800-821-2794) for more information.

Reader Service **570**

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For more information contact Sweetware Inc., 516 Shelburne Road, S. Burlington, VT 05401, 802-862-6939.

Reader Service **569**

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